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THE STATE FORESTER OF MASSACHUSETTS.

SEVENTH ANNUAL REPORT.

1910.

F. W. RANE, State Forester.

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Approved by
The State Board of Publication.

The Commonwealth of Massachusetts.

To the General Court.

The State Forester takes pleasure in presenting this, his seventh annual report, enumerating the activities, accomplishments and expenditures of the past year, with recommendations for the future needs of the department.

As in the preceding year, the report is divided into two parts: —

Part I. General Forestry.
Part II. Gypsy and Brown-tail Moth Work.

This report is submitted in accordance with the provisions of chapter 409, section 5, Acts of 1904.

Respectfully submitted,

F. W. RANE,
State Forester.

Dec. 1, 1910.

CONTENTS.

PART I. — GENERAL FORESTRY.

The Massachusetts State Forester and staff. By the use of an automobile from the main office, and having the division superintendents supplied with motor cycles, the work is now more efficient with twenty men than heretofore with fifty-four.

The Commonwealth of Massachusetts.

SEVENTH ANNUAL REPORT OF THE STATE FORESTER.

Introduction.

Forestry work during the past year has received its due share of interest on the part of our Massachusetts people. It is a pleasure to be able to report that in general the forestry and moth work have so amalgamated that not only more efficiency but greater economy is the result.

The depredations of insect pests, fungous diseases and forest fires must be successfully dealt with and controlled if we are to succeed in establishing and maintaining a modern forestry system throughout this Commonwealth.

From the first the forestry work has been popular, while the moth work, on the other hand, has savored of unpopularity, for many reasons, but chiefly because of the law requiring property owners, through taxation, to defray a portion of its expense.

It has taken time to organize and perfect the work of combating the gypsy and brown-tail moths. It is believed to be a conservative estimate when we say that we have increased our efficiency toward moth control fully one-third during the past season, and without additional appropriations.

It has been the earnest endeavor of the State Forester, since the moth work has been placed under his care, to overcome, if possible, anything that has a tendency to create a misunderstanding, and also to secure legislation that would meet definite requirements and hence general public approval.

The legislation enacted by the last General Court has already proved of great assistance, and it is hoped that our requests as outlined at the conclusion of this report will meet with the favorable consideration of your honorable body.

It is believed that there are few departments in the State that have a more enthusiastic, self-sacrificing and loyal corps of employees than has this one. "A live-wire organization" is our slogan.

The demands upon the office of the State Forester for examinations and advice on forestry matters have been greater than ever; also, forestry literature, lectures and demonstrations have been constantly requested throughout the year. Fire-warning notices and forest-law posters have been generally distributed and are in greater use than ever.

The growing interest in equipping our towns with some modern fire-fighting apparatus is certainly encouraging. The legislation of last year, whereby the poorer towns receive State aid, has been of great assistance. The comparative efficiency of towns with and without equipment for fighting forest fires during the past season is proverbial. Towns with equipment were practically free from fires, while those without such equipment were largely burned over.

The reforestation work is extremely popular, and it is believed that the State can well afford to enlarge the appropriation for this work, as under our present method the State cannot possibly lose.

The State Forester feels frank to say that the outlook in this department was never brighter.

Organization.

The same general plan of organization as that outlined last year has been continued throughout the season. Our constant aim has been toward greater efficiency and raising the standard of the work. Our purpose is to encourage cities and towns to first secure competent forest wardens and moth superintendents, and then to desist from constant changes. It takes time to get a man well broken into the work, and thereafter he is of the greatest value.

The present organization of the State Forester's staff is as follows: —

STAFF.

Mr. F. W. RANE, B.Agr., M.S.,	State Forester.
Mr. L. H. WORTHLEY,	Assistant Forester, in charge of moth work.
Mr. H. O. COOK, M.F.,	Assistant Forester, in charge of forestry management.
Mr. R. S. LANGDELL,	Assistant Forester, in charge of nursery work.
Mr. H. F. GOULD, M.F.,	Assistant Forester.
Mr. J. H. POTTS,[1]	Assistant, forest fire work.
ALDEN T. SPEARE,	Assistant, moth disease work.
Mr. CHAS. O. BAILEY,	Secretary.
Miss ELIZABETH HUBBARD,	Clerk, in charge of accounts.
Miss CHARLOTTE JACOBS,	Clerk, in charge of mail and office.
Mr. WM. A. HATCH,	Division Superintendent, Division 1, as follows: Danvers, Hamilton, Ipswich, Lynn, Lynnfield, Nahant, Peabody, Revere, Salem, Swampscott and Wenham.
Mr. JOHN W. ENWRIGHT,	Agent, Division 2, as follows: Arlington, Bedford, Burlington, Carlisle, Everett, Lexington, Malden, Melrose, No. Reading, Reading, Saugus, Stoneham, Wakefield, Wilmington, Winchester and Woburn.
Mr. GEORGE A. SMITH,	Agent, Division 3, as follows: Belmont, Boston, Brookline, Cambridge, Chelsea, Concord, Hyde Park, Lincoln, Medford, Natick, Needham, Newton, Somerville, Waltham, Watertown, Wayland, Wellesley, Weston and Winthrop.
Mr. FRANK A. BATES,	Agent, Division 4, as follows: Abington, Avon, Braintree, Cohasset, Hingham, Holbrook, Hull, Milton, Quincy, Randolph, Rockland, Scituate, Weymouth and Whitman.
Mr. FRANCIS C. WORTHEN,	Division Superintendent, Division 5, as follows: Amesbury, Boxford, Georgetown, Groveland, Merrimac, Middleton, Newbury, Newburyport, Rowley, Salisbury, Topsfield and West Newbury.
Mr. JOHN J. FITZGERALD,	Division Superintendent, Division 6, as follows: Andover, Billerica, Chelmsford, Dracut, Haverhill, Lawrence, Lowell, Methuen, North Andover and Tewksbury.
Mr. WM. W. COLTON,	Division Superintendent, Division 7, as follows: Ashby, Ashburnham, Ayer, Dunstable, Fitchburg, Groton, Lunenburg, Pepperell, Shirley, Townsend, Westford and Westminster.
Mr. CLARENCE W. PARKHURST,	Division Superintendent, Division 8, as follows: Bellingham, Canton, Dedham, Dover, Foxborough, Framingham, Franklin, Medfield, Medway, Millis, Norfolk, Norwood, Plainville, Sharon, Sherborn, Stoughton, Walpole, Westwood and Wrentham.
Mr. CHAS. W. MINOTT,	Agent, Division 9, as follows: Acton, Berlin, Bolton, Boxborough, Clinton, Harvard, Hudson, Lancaster, Leominster, Littleton, Marlborough, Maynard, Sterling, Stowe and Sudbury.

[1] Resigned.

Mr. George A. Sands,	Division Superintendent, Division 10, as follows: Ashland, Blackstone, Grafton, Holliston, Hopedale, Hopkinton, Mendon, Milford, Northborough, Northbridge, Southborough, Upton, Uxbridge and Westborough.
Mr. Harry B. Ramsey,	Agent, Division 11, as follows: Athol, Auburn, Barre, Boylston, Brookfield, Charlton, Douglas, Dudley, Gardner, Holden, Hubbardston, Leicester, Millbury, Orange, Oxford, Paxton, Petersham, Phillipston, Princeton, Rutland, Royalston, Spencer, Sturbridge, Sutton, Templeton, Webster, West Boylston, Winchendon and Worcester.
Mr. John A. Farley,	Agent, Division 12, as follows: Carver, Duxbury, Halifax, Hanover, Hanson, Kingston, Marshfield, Norwell, Pembroke, Plymouth and Plympton.
Mr. Lewis W. Hodgkins,	Agent, Division 13, as follows: Attleborough, Bridgewater, Brockton, East Bridgewater, Easton, Lakeville, Mansfield, Middleborough, North Attleborough, Raynham, Taunton and West Bridgewater.
Mr. John F. Carleton,	Division Superintendent, Division 14, as follows: Barnstable, Bourne, Brewster, Dennis, Falmouth, Marion, Mashpee, Orleans, Rochester, Sandwich, Truro, Wareham, Wellfleet and Yarmouth.
Mr. Saul Phillips,	Division Superintendent, Division 15, as follows: Beverly, Essex, Gloucester, Manchester, North Shore Woodlands and Rockport.

Co-operative Scientific Staff.

L. O. Howard, Ph.D.,	Chief United States Bureau of Entomology, Washington, D. C., *Parasites and Predaceous Insects.*
Theobald Smith, Ph.B., M.D.,	Professor of Comparative Pathology, Harvard University, *Diseases of Insects.*
Roland Thaxter, Ph.D.,	Professor of Cryptogamic Botany, Harvard University, *Fungous Diseases affecting Insects.*
E. L. Mark, Ph.D., LL.D.,	Director of the Zoölogical Laboratory, Harvard University, *Protozoa and Insect Life.*
W. M. Wheeler, Ph.D.,	Professor of Entomology, Harvard University, *Experimental Entomologist.*
C. H. Fernald, Ph.D.,	Professor of Entomology, Massachusetts Agricultural College, *Consulting Entomologist.*
Frank H. Mosher,	Entomologist in charge of laboratory.

List of Forest Wardens and Local Moth Superintendents.

[Alphabetically by towns.]

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Abington,	287	B. E. Wilkes, chief fire department,	C. Frederick Shaw.
Acton,	181	Wm. H. Kingsley,	James O'Neil.
Acushnet,	275	Henry F. Taber,	A. P. R. Gilmore.
Adams,	7	John Clancy,	– –
Agawam,	93	D L. White, P. O. Feeding Hills,	– –
Alford,	24	John H. Wilcox,	– –
Amesbury,	228	James E. Feltham, chief fire department,	A. L. Stover.
Amherst,	67	G. E. Stone, tree warden,	
Andover,	212	J. H. Playdon, tree warden,	J. H. Playdon.
Arlington,	193	Walter H. Pierce, chief fire department,	Wm. H. Bradley.
Ashburnham,	104	Arthur H. Skillings, chief fire department,	Chas. A. Billings.
Ashby,	158	Wm. S. Green,	H. A. Lawrence.
Ashfield,	50	Chas. A. Hall,	– –
Ashland,	200	H. H. Piper,	Michael Geoghan.
Athol,	105	Frank P. Hall, chief fire department,	Geo. E. Whitney.
Attleborough,	265	Hiram Packard, chief fire department, 3 Hope Street.	Wm. E. S. Smith.
Auburn,	123	J. Fred Searle,	J. Fred Searle.
Avon,	259	James W. McCarthy, Pratt Street,	Willard W. Beals.
Ayer,	169	Chas. E. Perrin,	Daniel W. Mason.
Barnstable,	315	Henry C. Bacon, P. O. Hyannis,	Harry W. Bodfish.
Barre,	142	D. H. Rice,	George R. Simonds.
Becket,	23	Elmer D. Ballou,	– –
Bedford,	179	Chas. E. Williams,	W. A. Cutler.
Belchertown,	73	James A. Peeso, constable,	Nelson Randall.
Bellingham,	326	L. F. Thayer,	Henry A. Whitney.
Belmont,	194	John F. Leonard, chief fire department,	Chas. H. Houlahan.
Berkley,	271	Gideon H. Babbitt,	J. M. Alexander.
Berlin,	139	Walter Cole, constable,	Ernest C. Ross.
Bernardston,	39	E. E. Benjamin,	– –
Beverly,	220	Robt. H. Grant, chief fire department,	Josiah B. Brown.
Billerica,	173	Geo. C. Crosby, chief engineer fire department.	Henry E. Marion.
Blackstone,	114	Thomas Reilly,	A. J. Gibbons.
Blandford,	81	C. O. Shultz,	– –
Bolton,	146	Chas. E. Mace,	Chas. E. Mace.
Boston,[1]	–	– – –	D. Henry Sullivan.
Bourne,	311	Walton E. Keene,	Stillman B. Wright.

[1] No forest area.

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Boxborough,	182	M. L. Wetherbee,	John J. Sherry.
Boxford,	218	Harry L. Cole,	Chas. Perley.
Boylston,	138	Chas. S. Knight, metropolitan watchman,	George A. Vickery.
Braintree,	244	Jas. M. Cutting, special police, P. O. South Braintree.	Oscar A. Hubbard.
Brewster,	318	T. B. Tubman, highway surveyor, North Brewster.	James E. Eldridge.
Bridgewater,	293	Edwin S. Rhoades,	Walter E. Rhodes.
Brimfield,	99	Geo. E. Hitchcock,	– –
Brockton,	286	Harry L. Marston, chief fire department,	N. S. Souther.
Brookfield,	120	David N. Hunter,	J. H. Conant.
Brookline,	237	Geo. H. Johnson, chief fire department,	Ernest B. Dane.
Buckland,	49	Wm. Sauer, P. O. Shelburne Falls,	– –
Burlington,	178	Walter W. Skelton, tree warden,	Walter W. Skelton.
Cambridge,[1]	–	– – –	J. F. Donnelly.
Canton,	249	Lawrence Horton, fire engineer, P. O. Ponkapoag.	Augustus Heminway.
Carlisle,	171	A. Lapham,	G. G. Wilkins.
Carver,	304	Herbert F. Atwood,	Herbert F. Atwood.
Charlemont,	42	Fred. D. Legate,	– –
Charlton,	115	Carlos Bond,	John G. Hammond.
Chatham,	320	Geo. W. Ryder, West Chatham,	Geo. B. Bassett.
Chelmsford,	172	Arthur E. Barton,	M. A. Bean.
Chelsea,[1]	–	– – –	J. A. O'Brien.
Cheshire,	11	Chas. D. Cummings,	– –
Chester,	80	Wm. H. Babb,	– –
Chesterfield,	63	Chas. A. Bisbee, P. O. Bisbee,	– –
Chicopee,	87	John H. Pomphret, chief fire department,	– –
Chilmark,	308	Ernest C. Mayhew,	Almon S. Tilton.
Clarksburg,	3	Robert Lanfair, R. F. D. No. 1, North Adams.	– –
Clinton,	145	Wm. Clark,	Wm. McGown.
Cohasset,	246	Wm. J. Brennock, captain fire department.	Joseph E. Grassie.
Colrain,	37	Wm. H. Davenport,	– –
Concord,	180	G. M. Morrell, chief fire department,	H. P. Richardson.
Conway,	51	Chas. Parsons, tree warden,	– –
Cummington,	60	W. S. Gabb, P. O. Swift River,	– –
Dalton,	14	Alvah K. Cleveland, North Street,	– –
Dana,	147	Thos. L. Thayer, P. O. North Dana,	– –
Danvers,	345	Thomas E. Tinsley,	Thomas E. Tinsley.
Dartmouth,	278	Sylvanus P. Hawes,	– –

[1] No forest area.

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Dedham,	241	Henry Harrigan,	George A. Phillips.
Deerfield,	52	Wm. L. Harris,	– –
Dennis,	317	Alpheus P. Baker, constable, P. O. South Dennis.	H. H. Sears.
Dighton,	272	Ralph Earle,	D. F. Lane.
Douglas,	112	W. L. Church,	Walter E. Carpenter.
Dover,	240	John Breagy,	Harold McKenzie.
Dracut,	163	Frank H. Gunther, chief fire department,	Thomas F. Carrick.
Dudley,	110	F. A. Putnam,	Joseph N. O'Kane.
Dunstable,	161	Archie W. Swallow,	James A. Davis.
Duxbury,	303	Fred. B. Knapp,	Henry A. Fish.
E. Bridgewater,	298	Loren A. Flagg, chief fire department, P. O. Elmwood.	Benjamin Taylor.
East Longmeadow,	95	E. J. Speight,	– –
Eastham,	322	W. Horton Nickerson, road surveyor,	N. P. Clark.
Easthampton,	77	Frank P. Newkirk, tree warden,	– –
Easton,	264	John Baldwin, chief fire department, North Easton.	R. W. Melendy.
Edgartown,	309	Manuel Roberts,	Theodore S. Wimpenny.
Egremont,	29	Frank W. Bradford, Great Barrington, R. F. D. No. 3.	– –
Enfield,	74	Chas. W. Felton,	– –
Erving,	46	Chas. H. Holmes, P. O. Farley,	– –
Essex,	223	Otis O. Story, tree warden,	Otis O. Story.
Everett,[1]	–	– – –	James Davidson.
Fairhaven,	276	Albert C. Aiken,	Geo. W. King.
Fall River,	280	William Mulligan, tree warden,	Wm. Mulligan.
Falmouth,	312	Herbert N. Lawrence,	W. B. Bosworth.
Fitchburg,	157	Geo. H. Hastings,	Geo. H. Hastings.
Florida,	5	E. L. Jeffries, North Adams, R. F. D. No. 3.	– –
Foxborough,	261	Ernest A. White, chief fire department,	Samuel J. Johnston.
Framingham,	197	Josiah S. Williams, P. O. Nobscot,	N. I. Bowditch.
Franklin,	255	Ed. S. Cook, dealer in wood and lumber,	John N. Stobbert.
Freetown,	274	Andrew M. Hathaway, P. O. Assonet,	Gilbert M. Nichols.
Gardner,	153	Geo. S. Hodgman,	T. W. Danforth.
Gay Head,	343	Leander B. Smalley, Menemsha,	L. B. Smalley.
Georgetown,	224	Clinton J. Eaton,	Clinton J. Eaton.
Gill,	45	Lewis C. Munn,	– –
Gloucester,	234	Sydney F. Haskell, Essex Avenue,	Herbert J. Worth.
Goshen,	61	Sydney F. Packard, Williamsburg, R. F. D. No. 2.	– –
Gosnold,	344	Harold S. Veeder, P. O. Cuttyhunk,	– –

[1] No forest area.

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Grafton,	125	Sumner F. Leonard,	Chas. K. Despeau.
Granby,	79	C. N. Rust,	– –
Granville,	91	Lawrence F. Henry,	– –
Great Barrington,	25	Dan W. Flynn, 54 Russell Street,	– –
Greenfield,	44	Wm. A. Ames, tree warden,	Wm. A. Ames.
Greenwich,	327	Wm. H. Walker, P. O. Greenwich Village,	– –
Groton,	167	Jas. B. Harrington, chief fire department,	Joseph F. Bateman.
Groveland,	225	Sydney E. Johnson, 311 Center Street,	Raymond B. Larive.
Hadley,	66	Edward P. West, tree warden,	– –
Halifax,	299	Edwin H. Vaughn,	Frank D. Lyon.
Hamilton,	222	Fred Berry, P. O. Essex, R. F. D.,	Erle G. Brewer.
Hampden,	97	John S. Swenson,	– –
Hancock,	9	Chas. F. Tucker,	– –
Hanover,	295	Chas. E. Damon, P. O. Box 113, North Hanover.	Lyman Russell.
Hanson,	296	Albert L. Dame, tree warden, P. O. South Hanson.	A. L. Dame.
Hardwick,	141	Myron N. Ayers,	– –
Harvard,	152	Benjamin J. Priest,	Geo. C. Maynard.
Harwich,	319	John Condon,	John H. Drum.
Hatfield,	65	John M. Strong, P. O. West Hatfield,	– –
Haverhill,	216	John B. Gordon, chief fire department,	Geo. F. Moore.
Hawley,	48	Ernest R. Sears, tree warden, P. O. Charlemont.	– –
Heath,	36	S. G. Benson,	– –
Hingham,	289	Geo. Cushing, chief fire department,	Arthur W. Young.
Hinsdale,	15	Lewis B. Breague, tree warden,	– –
Holbrook,	247	E. W. Austin,	Wm. Haydon.
Holden,	136	Henry E. Holt,	H. E. Holt.
Holland,	101	O. F. Howlett, P. O. Southbridge, R. F. D. No. 2.	– –
Holliston,	202	Waldo E. Coolidge,	Geo. H. Moody.
Holyoke,	85	Chas. C. Hastings,	– –
Hopedale,	328	Walter F. Durgin, superintendent of parks.	Walter F. Durgin.
Hopkinton,	201	R. I. Frail,	F. F. Baldwin.
Hubbardston,	149	Ernest A. Young, tree warden,	Ernest A. Young.
Hudson,	199	Fred W. Trowbridge, chief fire department.	Frederick P. Hosmer.
Hull,	329	Smith F. Sturgis, tree warden, P. O. Allerton.	John Knowles.
Huntington,	70	Daniel B. Mack,	– –
Hyde Park,	330	Harry G. Higbee,	Harry G. Higbee.
Ipswich,	223	Augustus J. Barton,	James A. Morey.

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Kingston,	301	Arthur B. Holmes,	Carl C. Faunce.
Lakeville,	283	Nathan F. Washburn, P. O. Middleborough.	S. T. Nelson.
Lancaster,	151	Everett M. Hawkins, chief fire department.	Geo. F. Morse, Jr.
Lanesborough,	10	King D. Keeler,	– –
Lawrence,	214	Chas. G. Rutter, chief fire department,	Isaac Kelley.
Lee,	22	Jas. W. Bossidy,	– –
Leicester,	122	Chas. White, P. O. Cherry Valley,	J. H. Woodhead.
Lenox,	18	Geo. W. Fitch,	– –
Leominster,	155	Fred A. Russell,	S. R. Walker.
Leverett,	57	Orman C. Marvel,	– –
Lexington,	188	Azor P. Howe,	E. P. Merriam.
Leyden,	38	Herma W. Severance, P. O. Bernardston,	– –
Lincoln,	187	Edwin R. Farrer, tree warden,	Edw. R. Farrer.
Littleton,	170	A. E. Hopkins,	Alfred Hopkins.
Longmeadow,	94	Oscar C. Pomeroy,	– –
Lowell,	165	Edward S. Hosmer, chief fire department,	Chas. A. Whittet.
Ludlow,	88	Edward E. Chapman,	– –
Lunenburg,	156	Clayton E. Stone,	Myron E. Harvey.
Lynn,	331	Nathan M. Hawkes, park commissioner,	Albert C. Doak.
Lynnfield,	209	Thos. E. Cox, P. O. Wakefield, R. F. D.,	Alfred W. Copeland.
Malden,	191	Frank Turner, chief fire department,	George W. Stiles.
Manchester,	236	Frederick Burnham,	John D. Morrison.
Mansfield,	263	Herbert E. King,	W. O. Sweet.
Marblehead,	332	Wm. H. Stevens,	Wm. H. Stevens, 2d.
Marion,	306	Geo. B. Nye,	James H. Morss.
Marlborough,	198	Chas. H. Andrews, chief fire department,	Timothy J. Brennan.
Marshfield,	292	Edward E. Ames,	P. R. Livermore.
Mashpee,	313	Joseph A. Peters,	Watson F. Hammond.
Mattapoisett,	281	Everett C. Stetson,	Geo. E. Barrows.
Maynard,	184	Arthur J. Coughlan, Maynard's block,	Albert Coughlan.
Medfield,	252	Waldo E. Kingsbury, chief fire department.	Geo. L. L. Allen.
Medford,	192	Chas. Bacon, chief fire department,	Wm. J. Gannon.
Medway,	254	Clyde C. Hunt, captain fire department,	Frank Hager.
Melrose,	–	– – –	John J. McCullough.
Mendon,	119	Geo. B. Cromb,	Frank M. Aldrich.
Merrimac,	227	Edgar P. Sargent,	Chas. R. Ford.
Methuen,	213	Herbert B. Nichols,	Alfred H. Wagland.

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Middleborough,	284	C. W. Weston,	– –
Middlefield,	342	Thos. H. Fleming, P. O. Bancroft,	– –
Middleton,	211	Oscar H. Sheldon,	B. T. McGlauflin.
Milford,	127	Elbert M. Crockett, chief fire department.	Patrick F. Fitzgerald.
Millbury,	124	Wm. E. Horn,	Edw. F. Roach.
Millis,	253	Chas. La Croix,	Fred Holland.
Milton,	242	Nathaniel T. Kidder, park commissioner,	Nathaniel T. Kidder.
Monroe,	34	S. R. Tower,	– –
Monson,	98	Omer E. Bradway,	– –
Montague,	53	Fred W. Lyman, lumber dealer,	– –
Monterey,	28	J. H. Bills,	– –
Montgomery,	82	Frank C. Preston, P. O. Huntington,	– –
Mt. Washington,	30	Ira L. Patterson,	– –
Nantucket,	333	Albert R. Coffin,	Geo. M. Winslow.
Nahant,	–	Thos. Roland,	Thomas Roland.
Natick,	204	Wm. E. Daniels,	H. H. Hunnewell.
Needham,	238	Howard H. Upham, chief fire department.	Ernest E. Riley.
New Ashford,	6	Wm. E. Baker,	– –
New Bedford,	277	Edward F. Dahill, chief fire department,	Chas. F. Lawton.
New Braintree,	131	E. L. Havens,	– –
New Marlborough,	32	Jas. McLaughlin, P. O. Mill River,	– –
New Salem,	55	Rawson King, P. O. Cooleyville,	– –
Newbury,	231	Wm. P. Bailey,	O. B. Tarbox.
Newburyport,	230	Chas. P. Kelley,	Chas. P. Kelley.
Newton,	205	Walter B. Randlett, chief fire department, P. O. West Newton.	Chas. I. Bucknam.
Norfolk,	256	Andrew R. Jones,	C. Albert Murphy.
North Adams,	4	H. J. Montgomery, chief fire department,	– –
North Andover,	215	Geo. A. Rea,	Peter Holt.
N. Attleborough,	262	Harvey W. Tufts, chief fire department,	F. P. Toner.
North Brookfield,	129	Harold A. Foster,	Samuel D. Colburn.
North Reading,	175	Irving F, Batchelder,	Geo. E. Eaton.
Northampton,	72	Frederick E. Chase,	– –
Northborough,	140	T. P. Haskell,	T. P. Haskell.
Northbridge,	117	W. E. Burnap, P. O. Whitinsville,	Arthur F. Whitin.
Northfield,	40	Fred. W. Doane,	– –
Norton,	266	Alden G. Walker,	Owen G. Walker.
Norwell,	290	John Whalen,	John H. Sparrell.

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Norwood,	250	J. Fred Boyden, chief fire department,	H. Frank Winslow.
Oak Bluffs,	334	Frank W. Chase,	Patrick P. Hurley.
Oakham,	135	Chas. H. Trowbridge,	Chas. H. Trowbridge.
Orange,	47	Frank M. Jennison,	F. M. Jennison.
Orleans,	321	Chas. F. Poor,	Albert A. Smith.
Otis,	27	Chester R. Cromwell,	– –
Oxford,	335	T. M. Harrington,	Chas. G. Larned.
Palmer,	89	James Summers, chief fire department, P. O. Box 333.	C. H. Keith.
Paxton,	130	Fred A. Durgin,	Louis M. Robinson.
Peabody,	219	Michael V. McCarthy, Forest Street,	James F. Callahan.
Pelham,	68	E. A. Harris, P. O. Amherst,	– –
Pembroke,	294	Jos. J. Shepherd,	Calvin S. West.
Pepperell,	160	Geo. G. Tarbell, P. O. East Pepperell,	John Tune.
Peru,	16	John Frizell,	– –
Petersham,	148	Geo. P. Marsh,	Frank A. Hathaway.
Phillipston,	106	Wm. Cowlbeck, P. O. Athol, R. F. D. No. 3.	Wm. H. L. Coulbeck.
Pittsfield,	13	Lucien D. Hazard,	– –
Plainville,	59	Edward C. Barney,	Chas. N. Snell.
Plainfield,	309	Lestan E. Parker,	– –
Plymouth,	302	Herbert Morissey,	Abbott A. Raymond.
Plympton,	300	Thomas W. Blanchard,	David Bricknell.
Prescott,	69	Waldo H. Pierce, P. O. Greenwich Village,	– –
Princeton,	150	W. A. Williams,	Frank A. Skinner.
Provincetown,	325	James H. Barnett,	John M. Burch.
Quincy,	243	Peter J. Williams, chief fire department,	Andrew J. Stewart.
Randolph,	248	Chas. A. Wales, chief fire department,	James E. Blanche.
Raynham,	270	John V. Festing, chief fire department,	Geo. M. Leach.
Reading,	176	Herbert E. McIntire,	Henry M. Donegan.
Rehoboth,	268	Silas A. Pierce,	Stephen W. Robinson.
Revere,[1]	–	– – –	Geo. P. Babson.
Richmond,	17	T. B. Salmon,	– –
Rochester,	282	Wm. N. Smellie,	Chester B. Morse.
Rockland,	288	John H. Burke, clerk fire board,	Frank H. Shaw.
Rockport,	235	A. J. McFarland, P. O. Box 91,	Frank A. Babcock.
Rowe,	35	Merritt A. Peck,	– –
Rowley,	232	Daniel O'Brien,	Daniel O'Brien.
Royalston,	102	Willard W. White, P. O. South Royalston,	W. W. White.

[1] No forest area.

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Russell,	83	Sidney F. Shurtleff, highway surveyor,	– –
Rutland,	143	Henry Converse, chief fire department,	H. Edw. Wheeler.
Salem,[1]	–	– – –	Amos Stillman.
Salisbury,	229	Wm. H. Evans,	Henry C. Rich.
Sandisfield,	33	Lyman H. Clark, P. O. New Boston,	– –
Sandwich,	314	John F. Carleton, P. O. Spring Hill,	B. F. Denison.
Saugus,	207	Ole C. Christiansen,	Thos. E. Berrett.
Savoy,	8	Herbert H. Fitzroy, P. O. Savoy Center,	– –
Scituate,	291	Ernest R. Seaverns, chief fire department.	Percival S. Brown.
Seekonk,	267	John L. Barker, P. O. Attleborough, R. F. D. No. 4.	Harold F. Thompson.
Sharon,	251	A. A. Carpenter,	T. J. Leary.
Sheffield,	31	Arthur H. Tuttle,	– –
Shelburne,	43	H. O. Fiske, P. O. Shelburne Falls,	– –
Sherborn,	203	Milo F. Campbell, South Sherborn,	J. P. Dowse.
Shirley,	168	Melvin W. Longley, P. O. Shirley Centre,	A. A. Adams.
Shrewsbury,	132	Wm. E. Rice,	Frank L. Ott.
Shutesbury,	58	Minor A. Haskell,	– –
Somerset,	336	Wm. F. Griffiths, Swansea, R. F. D.,	Chas. Riley.
Somerville,[1]	–	– – –	Asa B. Pritchard.
South Hadley,	78	Joseph Beach, P. O. South Hadley Falls,	– –
Southampton,	76	Geo. W. Tyler,	– –
Southborough,	337	Harry Burnett, tree warden,	Harry Burnett.
Southbridge,	109	Aimee Langevin, Olney Avenue,	Joseph Proulx.
Southwick,	92	Lowell A. Mason,	– –
Spencer,	121	A. F. Howlett, chief fire department,	Geo. H. Ramer.
Springfield,	86	Burton Steere, assistant fire chief,	Wm. F. Gale.
Sterling,	144	G. F. Herbert,	Jos. H. Kilbourn.
Stockbridge,	21	Geo. Schneyer, P. O. Glendale,	– –
Stoneham,	190	Geo. E. Sturtevant, chief fire department,	Geo. M. Jefts.
Stoughton,	258	Jesse E. Smith,	Wm. P. Kennedy.
Stow,	183	Wm. H. Parker, P. O. Gleasondale,	Geo. A. Patterson.
Sturbridge,	108	Chas. M. Clark, P. O. Fiskdale,	– –
Sudbury,	185	F. E. Bent,	Wm. E. Baldwin.
Sunderland,	338	A. C. Warner,	– –
Sutton,	116	R. W. Richardson,	John E. Gifford.
Swampscott,	339	Geo. P. Cahoon, chief fire department,	Everett P. Mudge.
Swansea,	273	Thos. L. Mason, R. F. D. No. 2,	E. C. Gardner.

[1] No forest area.

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Taunton,	269	Fred. A. Leonard, chief fire department,	Alvaro Harnden.
Templeton,	107	Henry H. Seaver, P. O. Baldwinville,	John B. Wheeler.
Tewksbury,	364	Herbert W. Pillsbury,	Harris M. Briggs.
Tisbury,	310	Elmer C. Chadwick,	Presbury S. Luce.
Tolland,	90	Eugene M. Moore,	– –
Topsfield,	218	Geo. F. Averill,	C. W. Floyd.
Townsend,	159	F. J. Piper, chief fire department,	Geo. E. King.
Truro,	324	Naylor Hatch,	Joseph H. Atwood.
Tyngsborough,	162	Otis L. Wright,	Howard E. Noble.
Tyringham,	26	Geo. F. Knapp,	– –
Upton,	126	E. M. Baker, chief fire department,	Geo. H. Evans.
Uxbridge,	113	Louis F. Rawson,	H. T. Newell.
Wakefield,	208	Samuel T. Parker,	W. W. Whittredge.
Wales,	100	W. W. Eager,	– –
Walpole,	340	Horace A. Spear, Jr.,	Philip R. Allen.
Waltham,	195	Geo. L. Johnson, chief fire department,	Warren M. Ryan.
Ware,	75	L. S. Charbonneau, P. O. Box 25,	Fred E. Zeissig.
Wareham,	305	A. C. Keyes,	J. J. Walsh.
Warren,	119	Joseph St. George,	Alfred A. Warriner.
Warwick,	41	Chas. A. Williams,	– –
Washington,	19	Geo. Messenger, R. F. D., Becket,	– –
Watertown,	206	John C. Ford, tree warden,	John C. Ford.
Wayland,	196	Clarence S. Williams, Cochituate,	Daniel Graham.
Webster,	111	Arthur G. Pattison,	Carl Klebart.
Wellesley,	239	Fletcher M. Abbott, tree warden,	Fletcher M. Abbott.
Wellfleet,	323	Edwin P. Cook,	Everett S. Jacobs.
Wendell,	54	Geo. A. Lewis,	– –
Wenham,	221	Jacob D. Barnes, tree warden,	Jacob D. Barnes.
West Boylston,	137	Frank H. Baldwin, agent Metropolitan Water Board.	Chas. H. Baldwin.
West Bridgewater,	285	Warren P. Laughton,	Octave Belmore.
West Brookfield,	128	J. H. Webb,	– –
West Newbury,	226	Silas M. Titcomb, P. O. Byfield,	Robert J. Forsythe.
West Springfield,	341	A. A. Sibley,	– –
West Stockbridge,	20	Bernard Manning,	– –
West Tisbury,	307	Wm. J. Rotch,	John Pease.
Westborough,	133	James H. McDonald, chief fire department.	Walter Sullivan.
Westfield,	84	Geo. H. Byers, chief fire department, Arnold Street.	– –

List of Forest Wardens and Local Moth Superintendents — Con.

Town or City.	Badge No.	Forest Warden.	Local Moth Superintendent.
Westford,	166	John A. Healey, P. O. Graniteville,	Harry L. Nesmith.
Westhampton,	71	Levi Burt,	– –
Westminster,	154	John C. Goodridge, chief fire department.	Stillman Whitney.
Weston,	186	Edward P. Ripley,	Edw. P. Ripley.
Westport,	279	Herbert A. Sanford,	Jonathan B. Hicks.
Westwood,	251	Percy R. Dean,	C. H. Southerland.
Weymouth,	245	J. R. Walsh, East Weymouth,	Chas. L. Merritt.
Whately,	56	James A. Wood,	– –
Whitman,	297	Clarence A. Randall, tree warden,	Clarence A. Randall.
Wilbraham,	96	Henry I. Edson, P. O. North Wilbraham,	– –
Williamsburg,	64	Howard C. Pomeroy,	– –
Williamstown,	2	Daniel Hogan,	– –
Wilmington,	174	Joseph M. Hill, chief fire department, North Wilmington.	Oliver McGrane.
Winchendon,	103	Arthur L. Brown, chief fire department,	John G. Folsom.
Winchester,	189	Irving L. Symmes, chief fire department,	Samuel S. Symmes.
Windsor,	12	H. W. Ford,	– –
Winthrop,[1]	–	– – –	Frank W. Tucker.
Woburn,	177	Frank E. Tracy, chief fire department,	James H. Kelley.
Worcester,	131	Arthur V. Parker,	Harold J. Neale.
Worthington,	62	Howard C. Brewster,	– –
Wrentham,	260	E. S. Stone, captain fire department,	Wm. M. Gilmore.
Yarmouth,	316	Seth Taylor,	Chas. R. Bassett.

[1] No forest area.

New Legislation.

The following new legislation, relative to forestry matters, was enacted by the last General Court.

As the liberation of fire balloons during seasons of drought has been the cause of several extremely damaging forest fires during the past few years, and as their continued use would be a constant menace to property in the future, it seemed imperative that legislation should be enacted which would eliminate this danger. The following law was therefore passed: —

A view of the State Forester's exhibit on the better farming electric train.

Acts of 1910, Chapter 141.

An Act to prohibit the Use of Fire Balloons.

Be it enacted, etc., as follows:

It shall be unlawful within any city or town in this commonwealth for any person to liberate or fly fire balloons of any description. Whoever violates this act shall be punished by a fine of not more than one hundred dollars, or by imprisonment for not more than one month, or by both such fine and imprisonment. [*Approved March 2, 1910.*

The enactment of the following law will undoubtedly result in lessening the number and size of forest fires, by stimulating a desire on the part of many towns to adopt reasonable preventive measures, and to provide proper apparatus to extinguish fires when they do occur. This law is dealt with more in detail in the chapter devoted to forest fires.

Acts of 1910, Chapter 398.

An Act relative to Protection against Forest Fires.

Be it enacted, etc., as follows:

Section 1. Every town in the commonwealth with a valuation of one million five hundred thousand dollars or less which appropriates and expends money, with the approval of the state forester, for apparatus to be used in preventing or extinguishing forest fires or for making protective belts or zones as a defence against forest fires, shall be entitled, upon the recommendation of the state forester, approved by the governor, to receive from the treasury of the commonwealth a sum equal to one half of the said expenditure, but no town shall receive more than two hundred and fifty dollars.

Section 2. A sum not exceeding five thousand dollars in any one year may be expended in carrying out the provisions of this act.

Section 3. This act shall take effect upon its passage. [*Approved April 13, 1910.*

So numerous have been forest fires in Barnstable and Plymouth counties within the past few years, the cause of which in many cases has been attributed to the carelessness and indifference of berry pickers and camping parties, that many prominent citizens of those counties petitioned for legislation which, if properly enforced, would serve to lessen the danger of fire from the above-named source. The following law was therefore enacted: —

Acts of 1910, Chapter 478.

An Act relative to the Picking of Berries and Flowers and to Camping and Picnicking during Certain Months in the Counties of Barnstable and Plymouth.

Be it enacted, etc., as follows:

Section 1. It shall be unlawful for any unnaturalized, foreign-born person to pick wild berries or flowers, or to camp or picnic, upon any land of which he is not the owner, within the counties of Barnstable and Plymouth, between the first day of April and the first day of December, without first obtaining written permission so to do from the owner or owners of the land. The said written permit shall not be transferable, and shall be exhibited upon demand to the forest warden, or his deputies, of the town wherein the land is located, or upon demand of any sheriff, constable, police officer or other officer authorized to arrest for crime. Failure or refusal to produce said permit upon such demand shall be prima facie evidence of a violation of this act, and any forest warden or any duly authorized deputy forest warden, police officer, sheriff or other officer authorized to arrest for crime, may arrest without warrant any person who fails or refuses to display for inspection the said permit upon the demand of any of the officials named in this act.

Section 2. Whoever violates any provision of this act shall be punished by a fine of not more than fifty dollars, or by imprisonment for not more than thirty days, or by both such fine and imprisonment. [*Approved May 3, 1910.*

In response to the suggestion made by Governor Draper in his inaugural address, as well as the recommendation contained in the annual report of the State Forester, the law relative to the suppression of the gypsy and brown-tail moths was so amended as to make the office of local moth superintendent appointive rather than elective, and the appointees subject to the approval of the State Forester. The object of this legislation was to insure the appointment of thoroughly competent men to have charge of this important work in the cities and towns of the Commonwealth. The amendment was as follows: —

Acts of 1910, Chapter 150.

An Act relative to the Appointment of Local Superintendents for the Suppression of the Gypsy and Brown Tail Moths.

Be it enacted, etc., as follows:

Section 1. Section four of chapter three hundred and eighty-one of the acts of the year nineteen hundred and five, as amended by section two of chapter two hundred and sixty-eight of the acts of the year nineteen hundred and six, and by section one of chapter five hundred and twenty-one of the acts of the year nineteen hundred and seven, is hereby further amended by striking out at the beginning thereof, the words "Cities and towns by such public officer or board as they shall designate or appoint, shall under the advice and general direction of said superintendent", and inserting in place thereof the words: — The mayor and aldermen in cities and the selectmen in towns shall annually in the month of March or April appoint a local superintendent for the suppression of gypsy and brown tail moths. Said superintendent shall, under the advice and general direction of the state forester, — also by inserting after the word "herein", in the eighth line, the words: — The appointment of a local superintendent shall not take effect unless approved by the state forester, and when so approved, notice of the appointment shall be given by the mayor and aldermen or the selectmen to the person so appointed, — so that the first paragraph of said section as amended will read as follows: — *Section 4.* The mayor and aldermen in cities and the selectmen in towns shall annually in the month of March or April appoint a local superintendent for the suppression of gypsy and brown tail moths. Said superintendents shall, under the advice and general direction of the state forester, destroy the eggs, caterpillars, pupae and nests of the gypsy and brown tail moths within their limits, except in parks and other property under the control of the commonwealth, and except in private property, save as otherwise provided herein. The appointment of a local superintendent shall not take effect unless approved by the state forester, and when so approved, notice of the appointment shall be given by the mayor and aldermen or the selectmen to the person so appointed. When any city or town shall have expended within its limits city or town funds to an amount in excess of five thousand dollars in any one fiscal year, in suppressing gypsy or brown tail moths, the commonwealth shall reimburse such city or town to the extent of fifty per cent of such excess above said five thousand dollars.

Section 2. This act shall take effect upon its passage. [*Approved March 2, 1910.*

In order to legalize the acceptance by the State Forester, on behalf of the Commonwealth, of bequests or gifts made for the

purpose of promoting forestry in Massachusetts, the following law was enacted: —

Acts of 1910, Chapter 153.

An Act to authorize the State Forester to accept Bequests or Gifts on Behalf of the Commonwealth.

Be it enacted, etc., as follows:

Section 1. The state forester, with the approval of the governor and council, is hereby authorized to accept, on behalf of the commonwealth, bequests or gifts to be used for the purpose of advancing the forestry interests of the commonwealth, under the direction of the governor and council, in such manner as to carry out the terms of the bequest or gift.

Section 2. This act shall take effect upon its passage. [*Approved March 3, 1910.*

An act was passed to provide funds for carrying on the gypsy and brown-tail moth work, and for experimenting with parasites for destroying said moths, as follows: —

Acts of 1910, Chapter 234.

An Act making Appropriations for the Suppression of the Gypsy and Brown Tail Moths.

Be it enacted, etc., as follows:

Section 1. The sums hereinafter mentioned are appropriated, to be paid out of the treasury of the commonwealth from the ordinary revenue, for the purposes specified, to wit: —

For the suppression of the gypsy and brown tail moths in the year nineteen hundred and ten, and for expenses incidental thereto, a sum not exceeding one hundred and fifty thousand dollars, the same to be in addition to any amount heretofore appropriated for this purpose.

For experimenting with parasites or natural enemies for destroying said moths, and for expenses incident thereto, a sum not exceeding fifteen thousand dollars, in addition to any unexpended balance of a former appropriation for this purpose.

Section 2. This act shall take effect upon its passage. [*Approved March 18, 1910.*

Acknowledgments.

It gives the State Forester great pleasure to acknowledge the continued valuable services and loyal support which he has received through his assistants and workers in this department, whether it be in the office or field work, throughout the year.

The work on the part of all has been enthusiastically and willingly undertaken. All of the members of the staff are entitled to the greatest possible credit for their efficient services.

He also desires to express his great appreciation of the generous treatment and kindly assistance rendered him by all citizens, boards and officials with whom he has come in contact, and again to emphasize the kindly co-operation on the part of the United States government through Dr. L. O. Howard of the Bureau of Entomology and Mr. D. M. Rogers, field agent; also of Harvard University, through Dean W. C. Sabine and the departments represented on the co-operative scientific staff.

Steam Railroad "Farming Special" Train.

The needs of better farming methods and a much greater production from farming lands are receiving much attention all over this country. Here in our own State this feeling has been materially augmented during the past year through the earnest endeavors of the State Forester, the State Board of Agriculture and the Massachusetts Agricultural College, aided by the Boston & Albany Railroad, to exploit the opportunities that exist for land owners of the Old Bay State. In line with this movement, the Boston & Albany Railroad ran a "Better Farming Special" over its road March 30 and 31 and April 1 and 2, consisting of five observation cars, fully equipped with exhibits representing every branch of agriculture and forestry.

The "Better Farming Special" visited the following cities and towns: —

Wednesday, March 30. — Westfield; Pittsfield; Cheshire; North Adams.

Thursday, March 31. — Chester; Springfield; Enfield; New Salem; Athol.

Friday, April 1. — Templeton; Barre Plains; Ware; Palmer; East Brookfield.

Saturday, April 2. — Worcester; Westborough; South Framingham; Milford.

At each place the special was met by hundreds of farmers, who in many instances had driven miles to enjoy the privilege of

listening to the lectures on the many themes relating to farming, as given by the representatives of the Massachusetts Agricultural College and the State Board of Agriculture; also, the development of forestry and the work of suppressing the gypsy and brown-tail moths, as presented by the State Forester and his assistants. At some of the stations were gathered whole schools, in charge of their teachers, and great interest was shown by them in both the lectures and the exhibits.

One entire car was devoted to forestry, under the direction of the State Forester, and included in the exhibits were the following: —

Pine seedlings, varying in age from one to three years.
Photographs showing modern and approved methods of forestry management and reforestation work.
Photographs showing fires, and damage done by same.
Complete equipment for forest-fire fighting.
Living gypsy moth caterpillars.
Living brown-tail moth caterpillars.
Mounted specimens showing the life history of the gypsy and brown-tail moths.
A large collection of parasites, such as have been imported from abroad.
Living Calosoma beetles.
Several species of native predaceous beetles of the gypsy moth.
Photographs showing different methods used in moth-suppression work.
Photographs of apparatus used in moth-suppression work.
Trees showing the proper method of treating cavities by tin patching.
Oak tree, showing brown-tail moth webs in their winter stage.
Living egg parasites.
Specimens of many other insects of economic importance.

The forest-fire wagon, designed and equipped under the direction of the State Forester, attracted much attention and received favorable comment from scores of town officials, who manifested a great deal of interest in the forest-fire problem. Another feature of the State Forester's exhibit which created widespread interest was the living specimens of the gypsy and brown-tail moth caterpillars, which gave to hundreds of people their first opportunity to see these dangerous insect pests.

Evening meetings were held at North Adams, Athol and

Worcester, and large and enthusiastic audiences were addressed by leading men on agricultural and allied topics.

The enterprise from start to finish was declared a pronounced success, and without doubt proved to be a valuable factor in stimulating and advancing the farming and forestry interests of Massachusetts.

Electric Railroad "Farming Special" Train.

So marked was the value of the exhibition to the farming interests of the territory traversed by the Boston & Albany special that the officials of the New England Investment and Security Company, which controls between nine hundred and one thousand miles of trolley lines in western Massachusetts, immediately tendered the Agricultural College and State department, without expense, every facility and convenience which they had to offer in running a trolley special over their lines in sections of the State not covered by the former trip.

In accordance with this plan, on April 14 four cars, equipped in practically the same manner as those of the Boston & Albany special, left Amherst on a three-days tour of education. The itinerary was as follows: —

Thursday, April 14. — South Hadley; Russell; Huntington; Springfield.

Friday, April 15. — North Wilbraham; Brimfield; Sturbridge; Charlton Center.

Saturday, April 16. — Oxford; Holden; Sterling; Worcester.

Much enthusiasm and interest greeted the special at every stop. At South Hadley nearly three hundred students of Mt. Holyoke College attended the demonstrations and enjoyed the lectures.

A splendid agricultural rally was held at Springfield on the evening of the 14th, under the auspices of the Springfield Board of Trade, where over five hundred business men listened to an address by President Butterfield of the Massachusetts Agricultural College, in which he impressed upon them the importance of co-operation in advancing the interests of commercial farming in our State.

This was undoubtedly the first trolley "farming special" ever attempted in this country, and its success proves that a grand service can by this means be rendered agricultural education in the future.

Publications of the State Forester.

It has been the aim of the office to publish as rapidly as possible such information as our people desire regarding forestry in its various phases. As requests came in, the department has anticipated the requirements, and has written bulletins which give in a practical and workable way detailed information, so that our people will not lack for guidance in actually accomplishing something, if they are so inclined.

At present we have a list of bulletins which cover fairly well the general information most likely to be required. By being able to furnish a bulletin which goes more into detail than is possible in a letter, the State Forester can do himself great justice.

We do not attempt sending out the whole list of bulletins unless specially requested to do so, or unless we feel sure that they are likely to be appreciated and used. The department has a mailing list of about 3,000 names of those who have shown some special interest in forestry. The mailing list is revised occasionally by writing and asking if the bulletins are still desired.

Two publications issued by the State Forester were so eagerly sought after that the Legislature believed it advisable that they be sold at cost; hence they are the only exceptions in the list. These are especially valuable in the identification of trees and in school work. The list of publications of the department follows: —

*1. Forest Trees of Massachusetts: how you may know them. A Pocket Manual.
*2. The Study of Trees in our Primary Schools.
3. Massachusetts Wood-using Industries.
4. The Evergreens. Methods of Study in Public Schools.
5. Re-forestation in Massachusetts.
6. How and when to collect White Pine Seed.
7. Forest mensuration of the White Pine. How to estimate Standing Timber.

8. How to make Improvement Thinnings.
9. We must stop Forest Fires in Massachusetts.
10. Forest fire-fighting Equipment in our Towns.
11. The Gypsy and Brown-tail Moths.
12. The Annual Report of the State Forester.
13. Laws relating to Forestry, and the Suppression of the Gypsy and Brown-tail Moths.
14. Colored Plates of the Gypsy and Brown-tail Moths and Calosoma Beetle.
15. Suggestions in Regard to Municipal Forests: a Practical Example.

[Note. — Under the resolves authorizing their publication, the two bulletins marked * must be sold by the State Forester at a price not less than their cost. Thus, the price of "Forest Trees of Massachusetts: how you may know them," is 5 cents a copy at the office, 6 Beacon Street, Boston, or 2 cents extra by mail; and of "The Study of Trees in our Primary Schools," 12 cents a copy, or 8 cents extra by mail. Any other bulletins in the list may be obtained at the office, or will be mailed upon request without cost.]

Part I.

GENERAL FORESTRY.

Part I.

GENERAL FORESTRY.

Examinations of Woodland.

The examination of private woodland for owners requesting such examination, one of the oldest branches of our work, has been carried on as in former years, and the even distribution over the whole year of the applications for such examinations, without extra solicitation on the part of this office, seems to indicate a steady and healthy interest on the part of the owners of this class of land. The work, as was explained last year, consists usually of a visit to the land in company with the owner or some other interested person, advice as to treatment given verbally on the ground, and often a subsequent written report.

This year an attempt has been made to keep in closer touch with examinees and the manner in which the recommendations of the office are carried out, by making a personal inspection, usually at a time when in the locality on other business. In this way owners were made to feel that an interest was being taken in their work, and in every case the office has felt well repaid by the results.

It has not been possible to make such inspections in large numbers, partly because the work was not begun till well along in the year, and partly because only those owners are visited where it is felt that enough time has elapsed to make the visit profitable. Enough has been done, however, to prove the advantages of the plan, and it is intended to push the work steadily during the coming season.

The following table gives a list of the examinations made, their location and area. A table of costs will be found at the end of this section of the report.

Owner.	Town.	Area (Acres).
Allen, P. R.,	Walpole,	5
Bent, F. E.,	Sudbury,	30
Borden, N. E.,	South Framingham,	60
Boston & Northern Street Railway,	Groveland,	38
Brayton, A. P.,	Somerset,	13
Brochu, J. E.,	Attleborough,	100
Burnett, H., trustee,	Hopkinton,	116
Chandler, J. F.,	Tyngsborough,	10
Creamer, F.,	Peru,	40
Cummings, W. O.,	Tyngsborough,	10
Cushing, J. S.,	Norwood,	2½
Dewar, D. W.,	Carlisle,	40
Eddy, Mary B.,	Newton,	10
Emerson, Dr. A. W.,	Norwood,	100
Fitchburg Water Board,	Westminster and Fitchburg,	400
Forrest, W. P.,	Foxborough,	22
Fowle, D. H.,	Newbury,	30
Fuller, W. A.,	Clinton,	49
Fuller, W. A.,	Harvard,	107
Fuller, W. A.,	Bolton,	128
Gerrish, Isabel F.,	Ashland,	47
Green, F. C.,	Bourne and Plymouth,	400
Harriman, C. S.,	North Wilmington,	4
Holmes, E. B.,	Abington,	30
Horne, W. N.,	Foxborough,	32
Hunnewell, H. H.,	Natick,	250
Jones, J. L.,	Halifax,	1,400
Lawrence, I. P.,	Ashburnham,	200
Mahoney, T. J.,	Wareham,	¼
Main, F. H.,	Lanesborough,	200
Manning, W.,	Marion,	400
Massachusetts Agricultural College, branch farm,	Sandwich,	20
Minns, Susan,	Princeton,	127
Minot, W.,	Wareham,	50
Morey, E.,	Ashland,	20
Nelson, H. W.,	Marshfield,	45
Pickman, D. L.,	Bedford,	400
Robinson, C. E.,	Hinsdale,	800
Sawyer, A. H.,	Salisbury,	30
Sears, Julia M.,	Tyngsborough,	30

Owner.	Town.	Area (Acres).
Seavey, H.,	Canton,	125
Simmons, H. F.,	Hanover,	10
Stevens, E. A.,	Duxbury,	40
Stevens, H. H.,	Marlborough,	30
Tenney, C. H.,	Methuen,	75
Tracy, Harriet E.,	Peru,	175
Webber, F. S.,	South Hadley,	10
White, J. H.,	Bridgewater,	25
Willets, H.,	New Marlborough,	200
Total,		6,495

In all, 17 inspections have been made, with an aggregate area of 1,080 acres: —

Owner.	Town.	Area (Acres).
Bird, C. S.,	Walpole,	60
Bridgman, H. A.,	Shirley,	15
Burbank Hospital,	Fitchburg,	400
Burgess, J. K.,	Dedham,	50
Codman, Catherine,	Dedham,	18
Emery, Miss M. E.,	West Newbury,	55
Fisher, Lewis N.,	Walpole,	7
Fiske, Warren,	Harvard,	200
Holmes, E. B.,	Abington,	30
Hutchins, C. L.,	Concord,	25
Joslin, E. P.,	Oxford,	100
Needham Water Board,	Needham,	5
Plympton, Mrs. A. L.,	Dover,	10
Prescott, C. W.,	Concord,	60
Stevens, Chas.,	Sudbury,	5
Thorndike, R. K.,	Millis,	20
Walpole High School,	Walpole,	20

Woodland Management.

The forestry department wishes to lay especial emphasis on another recent development of its work; namely, management of private woodlands by the owner, under the continuous super-

vision of this office. Under this plan, several private owners are this winter carrying on regular thinning improvement cutting, fire-line making and other forestry operations, under the more or less regular instruction and general supervision of a forestry assistant.

In one instance, that of the Burbank Hospital, treated more fully elsewhere, a regular lumbering operation was completed.

In any case the plan is doubly advantageous, both to the owner and the office, in that it is made possible for such owners to employ the same men used by the reforestation department in its spring planting, thus getting the profit of experienced labor at the same price that would have to be paid for inferior workmen; while at the same time the office is pleased to offer its men continuous employment, instead of losing all trace of them immediately at the close of the planting season. The owner, of course, pays all cost of the work, including travelling expenses of the expert from this office, the assistance only being given free.

In addition to the advantages already indicated, there is the far-reaching one of having within the State an ever-increasing number of men, and more particularly of competent bosses, who understand not only woods work but woods work along practical forestry lines; this body of men to act as a nucleus around which to build up an effective force for carrying out the many and increasingly difficult forestry problems which are pressing for immediate solution.

Owners and towns where the work described above either is or soon will be under way are as follows: —

R. B. Symmington, Plymouth, has thinned about 50 acres.

Francis C. Green, Buzzard's Bay, will make fire lines, thin and possibly plant.

Frederick W. Burnham, Buckland, is clear-cutting and thinning about 50 acres; will later turn over to State to plant.

I. P. Lawrence, Ashburnham, is planting 25 acres and may do some thinning.

It is hoped that in future we may be able to report a still further increase in this work, and one in keeping with its importance.

Pine trees left standing for reseeding purposes, on the Burbank Hospital property, at Fitchburg.

Forest Working Plan for the Burbank Hospital.

A year ago last spring the trustees of the Burbank Hospital asked this office to examine 250 acres of woodland belonging to the hospital. Mr. Cook, the assistant forester who made the examination, was greatly impressed with the evidence of present and future value in the land, and convinced the trustees that they should have a working plan made for the place. This was done in the fall of the same year. In this plan each type of land was carefully mapped out, and the treatment to be accorded each type was explained. In general, the report recommended the cutting of mature growth, the thinning and improving of growing stands, and the planting of such vacant land as was not needed for pasturing cattle.

Three lots were selected for immediate cutting. The first was covered with a growth of mixed hard woods, — chestnut, birch, pine, beech, oak, maple and hemlock. From the standpoint of merchantable volume, chestnut and white pine were the most prominent trees, and ranged in size from 7 to 25 inches, the average being from 12 to 16 inches. The plan for cutting called for the removal of all trees over 7 inches in diameter, breast high, except a few pines which were to be left to seed the cut-over land. The merchantable trees were to be left uninjured as far as possible, limbs and tops were to be worked up into cord wood, and the rest of the slash piled and burned. Practically all the chestnut, oak, pine, birch and hemlock trees were of merchantable size, whereas the maple and beech were very generally below it. The reason for selecting this lot for immediate cutting was that it had been more or less severely injured by fire in past years, and it was feared that the trees were slowly dying.

The second lot was 4 acres of heavy white pine, nearly pure. The trees averaged 15 inches in diameter, breast high, and 70 feet in height. It was estimated to run 35,000 feet to the acre, but turned out to contain much more. This lot was cut clean, with the exception of a few of the large, limby trees, which were left to seed the cut-over land. About 8 trees to the acre, and placed as evenly as possible over the cut area, were selected for this purpose. The spreading, bushy specimens were selected as

seed trees, because they produce the most seed and at the same time are the least valuable as lumber. Here, as on the other lot, the slash was piled and burned.

The third bunch of timber covered only 1½ acres, and was made up almost entirely of sprout chestnut. This lot was selected because the trees were over-mature, had decayed butts and were going back.

The method of handling this work, as agreed upon by Dr. Tower, superintendent of the hospital, and Mr. Cook, was briefly as follows: —

The chopping was to be done under the direct supervision of this office, and Mr. Winifred Eaton, one of our most trusted employees, was made foreman of the chopping gang. This arrangement was made because it was felt that the ordinary choppers could not be depended on to carry out the provisions of the working plan. This office looked on the job as an experiment in conservative logging, and was therefore anxious that everything be done in good faith. The sawing and sticking was done under contract by a Mr. Spencer, a portable-mill man. The hauling of the logs was done by the men and horses belonging to the hospital farm. Partly because these men were not experienced in this work, and partly because they had to pile the logs on skids, to remain until the mill was set up, the cost of logging was higher than is usual in this kind of work.

The following table shows the cost of the above operation: —

Operation.	Total.	Per 1,000 Feet.
Camp, material and tools,	$59 50	$0 19
Labor on camp,	15 70	05
Repairing old roads,	12 00	04
Chopping 95 cords pine, at 90 cents per cord,	85 50	90[1]
Chopping 110 cords hard woods, at $1.10 per cord,	121 00	1 10[1]
Lumber, 303,000 feet,	463 50	1 53
Sawing lumber,	695 75	2 30
Burning brush,	47 60	16
Logging and sticking,	888 70	2 93
Total, excluding cord wood,	$2,182 75	$7 20

[1] Per cord.

The total product was made up of both timber logs (303,000 feet) and cord wood (205 cords). In order to get at the cost of chopping the lumber, we deducted the value of the cord wood chopping, allowing 90 cents for each of the 95 cords of pine and $1.10 for each of the 110 cords of hard wood, these being the prices current for that work in that vicinity. The cost of chopping is somewhat higher than the average for that kind of work, — approximately 30 cents per 1,000 feet more; but the most of this difference can be laid to the labor of piling the brush for burning, and some to necessity for caring for the smaller trees.

Owing to the fact that a large number of timber lots were cut off in the neighborhood of Fitchburg last winter, the lumber market there experienced a slump, so that the hospital superintendent was unable to dispose of his supply at a price equal to what we had hoped for. For the 175,000 feet of round-edge pine he received $15 per 1,000 feet as it lay stacked on the lot; for the 53,000 feet of square-edge pine, $21; and for the 75,000 feet of mixed hard woods, only $14. The gross returns were $4,788, — an average price of $15.80 per 1,000 feet. Deducting from this amount $2,182, the cost of logging, sawing, etc., the net returns were $2,606, or $8.60 per 1,000 feet. This sum is somewhat more than they would have received had they sold the stumpage outright to a lumberman, because an offer of $8 per 1,000 feet was made for it. Also, under such circumstances the cutting would have been carried out without any regard for the future of the land, and the slash left in such a condition that a bad fire would have been unavoidable. We should estimate that the total extra cost of disposing of the slash on this job was about 40 cents per 1,000 feet of lumber cut.

Marking for Gypsy Moth Thinning.

In addition to examinations for private owners, and the marking entailed thereby, the work of the forestry assistants was extended over numerous areas in the eastern section of the State for thinning done by the gypsy moth employees. It was felt that the men, after cutting an area so marked, would soon

be able to combine a working knowledge of forestry methods with their already excellent acquaintance with gypsy moth requirements.

A total area of about 490 acres was marked for this sort of thinning, about 425 acres of which lay on the north shore of Massachusetts Bay, in the towns of Beverly, Manchester, Gloucester, Wenham and Essex. About one-half of the cutting done on the north shore was marked for by the forestry assistants, and it is now felt that the men are quite familiar with their methods of work.

Other localities in which marking was done or advice given were Tyngsborough, Tewksbury, Wareham, Hingham, Mashpee and Newton. In the latter place, where a particular effort was made to sell the cord wood product, the amount realized not only paid the cost of cutting, but also of cleaning up the brush, leaving a slight margin of profit.

Surveying.

Considerable surveying has been done by the forestry department during the year, including nearly all the unsurveyed lots taken under the reforestation act. These lots, by towns, are as follows: Buckland, 165 acres; Wellfleet, 52 acres; Harwich, 14 acres; Peru, 80 acres; Colrain, 12 acres; Oakham, 100 acres; a total of 449 acres.

Maps have been or are being made for all these lots. Besides this ordinary surveying and mapping, one topographic and forest map (in colors) has been made of a tract of land taken by the State under the reforestation act, and planted and managed by this office, known as the Lowe farm. This land lies in Colrain, has an area of 580 acres, and is the largest of the State plantations.

Reforestation Work.

The reforestation work has been carried on this year under the policy already established, and gives great promise of awakening the interest of mill owners, lumbermen and land owners to the necessity of replanting cut-over and waste lands. The lots planted last year, after being inspected this fall in some cases show as high as 97 per cent. of healthy growing trees, and

A portable steel shack, — one of those in use by the State Forester's department. Size, ten by twelve feet; capable of handling twelve men.

The State Forester's nursery at Amherst. White pine transplants in the foreground.

in no case has more than 40 per cent. died out. Even at this early date some of these lots have started to fill their mission of demonstrating, and influencing land owners to undertake forest planting. One party not owning land suitable for reforestation bought over 200 acres of cheap waste land, and intends planting it in the coming spring. Another party, owning 50 acres of run-out pasture land, became interested through looking over one of these plantations where young pine had been planted on land similar to his own. Many other parties, becoming interested, set out smaller areas.

Deeds for 921 acres have been recorded and the land planted last spring. In order to carry on the work, five galvanized-iron shacks were constructed, which will accommodate from eight to ten men, these shacks enabling the men to live on the lot during the planting season, and doing away with the necessity of transporting the men to and from work, as had been the case when the lot was a number of miles from any town. The average cost of planting was brought to a slightly lower cost through the use of these shacks and other economical methods.

State Plantations, 1910.

Town.	Acres.	Type of Land.	Variety planted.
Colrain,	80	Run-out pasture,	Norway spruce.
Colrain,	80	Run-out pasture,	Norway spruce.
Belchertown,	10	Run-out pasture,	White pine.
Colrain,	169	Run-out pasture,	White pine.
Colrain,	52	Run-out pasture,	Norway spruce.
Sandwich,	38	Burnt-over land,	Pitch and Scotch pine and Norway spruce.
Peru,	68	Run-out pasture,	Norway spruce and white pine.
Peru,	12	Run-out pasture,	Norway spruce and white pine.
Shirley,	14	Cut-over land,	White pine.
Hubbardston,	100	Cut-over land,	White pine.
Spencer,	14	Cut-over land,	White pine.
Paxton,	54	Cut-over land,	White pine.
Brookfield,	70	Cut-over land,	White pine.
Oakham,	100	Cut-over land,	White pine.
West Brookfield,	30	Cut-over land,	White pine.
Carlisle,	30	Cut-over land,	White pine.
Total area,	921		

PLANTING DONE UNDER ADVICE OF STATE FORESTER.

NAME.	Town.	Variety.	No. of Trees.
Amherst Water Company,	Amherst,	White pine,	15,000
N. D. Bill,	South Worthington,	White pine,	300,000
Needham Water Company,	Needham,	White pine,	5,000
Leominster Water Company,	Leominster,	White pine,	7,000
Long Island Almshouse,	Long Island,	White pine,	45,000
Dr. E. P. Joslin,	Oxford,	Norway spruce,	5,000
Brown Bros. and John Folsom,	Winchendon,	White pine,	150,000
Fred Barclay,	Spencer,	White pine,	20,000
I. P. Lawrence,	Ashburnham,	White pine,	20,000
Walter Clark,	Paxton,	White pine,	10,000
State Colony for Insane,	East Gardner,	White pine,	14,000
Faunce demonstration farm,	Sandwich,	White pine, etc.,	500
W. R. Rich,	Truro,	Pitch pine,	1,000
F. P. Stratton,	Concord,	Norway spruce,	1,000
Henry Pike,	Paxton,	White pine,	1,300

FOREST NURSERY.

The State forest nursery at Amherst will have about 2,000,000 two-year-old white pine seedlings fit for planting next spring. A large part of them should be transplanted in the nursery, if arrangement can be made for sufficient ground. Last spring we were able to use about 900,000 in the reforestation work, and transplanted at the nursery 250,000, that we might have trees which when planted in the most exposed places will grow sucessfully. We have also a good stand of one-year-old white pine and Norway spruce. The following table gives the estimated stock on hand at the nursery: —

VARIETY.	Age (Years).	No. of Trees.
White pine seedlings,	2	2,000,000
White pine seedlings,	1	2,500,000
Pitch pine seedlings,	2	25,000
Pitch pine seedlings,	1	25,000
Norway pine seedlings,	2	5,000
Austrian pine seedlings,	1	20,000

Variety.	Age (Years).	No. of Trees.
Scotch pine seedlings,	1	40,000
Norway spruce seedlings,	1	500,000
Balsam fir seedlings,	2	5,000
Hemlock seedlings,	2	5,000
Red spruce seedlings,	2	2,000
Black locust seedlings,	1	20,000
Catalpa speciosa seedlings,	1	5,000
Total,		5,152,000

Variety.	Age (Years).	No. of Trees.
White pine transplants,	4	25,000
White pine transplants,	3	250,000
Norway spruce transplants,	3	25,000
Black locust transplants,	2	2,000
Honey locust transplants,	2	2,000
Total,		304,000

Since the planting of last spring, the large number of applications by land owners to reforest their waste land under the reforestation act make it plain that it will be impossible to replant all the land which would be turned over to the State, unless the present limited appropriation is increased. At this time last year only about 500 acres of land had been offered under the act, the balance for last spring's work being taken over during the winter; this year already over 1,200 acres have been offered. Never before has such interest been taken in the work, and the outlook for the coming months is that many more tracts will be offered; and as under the present appropriation only about 1,000 acres can be planted, steps should be taken by the coming Legislature to meet the situation.

Instruction in Planting.

While the planting on State land occupies most of our attention during the spring, to the partial exclusion of other work, an attempt was made last year to give practical assistance on the ground to owners inexperienced in forest planting, who

were for the first time trying the experiment on a large scale. Advice of this nature was given to the following owners: —

Faunce demonstration farm, Sandwich, set out 500 seedlings.
Long Island Hospital, Boston harbor, set out 45,000 seedlings.
Fitchburg Water Board, Westminster, started a forest nursery.
E. P. Joslin, Oxford, set out 5,000 seedlings.
Needham Water Board, Needham, set out 5,000 seedlings.
I. P. Lawrence, Ashburnham, set out 25,000 seedlings; also set out 15,000 in a nursery.
State Colony for Insane, Gardner, set out 14,000 seedlings.

Reports from some of this work seem to indicate as good results as can be expected in the short time that has elapsed.

The seedlings at Long Island are in good condition, and it only remains to be seen how they will endure the coming winter.

The stock on the farm at Sandwich is in good shape, and it will be put to a rigid test this winter, having been planted as a windbreak against the heavy gales so prevalent on the Cape.

Portable Steel Shacks.

In the reforestation work of the past few years we have had difficulty in keeping the expense of planting uniform. There are many conditions that are accountable for it, such as the size and condition of the area, — as a larger tract can be handled more cheaply per acre than a smaller one; price of seedlings, etc.; but the greatest factor to be reckoned with has been the question of caring for the laborers. In some cases it was necessary to transport the men night and morning to and from the field, which was an extra expense. In order to overcome this, the department has constructed several portable steel shacks (see accompanying photograph), which are used to house and board the labor on the ground. These shacks were constructed in the State Forester's warehouse. The whole construction is of galvanized-iron sheets, which are held together with bolts and clasps. The only wooden parts are the door and two window sashes, one on each side. Twelve men can thus be accommodated. The following outline gives the size of the shack, equipment for setting it up, cooking utensils and planting tools used in the work; the approximate cost is also given.

With this device the whole environment of the work is im-

A natural seeding-in of pitch pine on the Cape. The land in the foreground is to be planted by the State Forester.

The beginning of a nursery at East Sandwich, Cape Cod, 1910. Four-year-old white pine transplants on left, set last spring; seed boxes of Scotch and Austrian pine on right.

proved, and the results, from an economic standpoint, are far more satisfactory. These shacks are used only when the plantings are in a locality where it is difficult to get board and room for the men, or where the work is at a distance from boarding places.

Cost of Steel Shack and Equipment.

Shack.

Size, 12 feet by 12 feet square; height, 9 feet front, 7 feet back,	$75 00
1 sliding window on each side,	
1 door in center of front,	
6 double bunks, 4 feet wide, 2 feet 4 inches between each,	

Equipment.

1 cook stove,	$5 00	
2 lanterns,	2 00	
1 kerosene can,	25	
1 hammer, axe and saw,	2 50	
1 pair wire cutters,	45	
2 shovels,	1 20	
1 chisel,	75	
	——	$12 15

Cooking Utensils.

1 large coffee pot,	$4 00
3 large kettles and covers,	
1 small kettle and cover,	
2 large frying pans,	
1 bean pot,	
3 large spoons,	
2 large knives,	
2 small knives,	
12 cups, plates, knives, forks and spoons,	
1 dipper,	
1 dish pan,	

Planting Tools.

6 grub hoes,	$3 00	
12 pails,	2 50	
	——	$5 50

1 chest for carrying equipment.

The bedding is furnished by the men.

Forest Fires of 1910.

It is with considerable reluctance that each year we include in our annual report a chapter on this painful subject, — pain-

ful, because forest fires are the greatest obstacle to the advancement of practical forestry in this Commonwealth, and because they form one of the most difficult problems with which we are obliged to deal; yet for these very reasons this chapter cannot be omitted from this book.

The subject of forest fires has been most vividly presented to the people of the United States during the past summer by the disastrous fires which raged in the northwest. We in our little State cannot experience such enormous conflagrations as these; yet the fire demon each year lays its insidious claws on a valuable portion of our natural heritage.

Last year 215 of the 354 towns and cities of the Commonwealth reported that they had 1,385 forest fires; 28, or 8.6 per cent., said that they had none; and 92, or 27.7 per cent., failed to report. There are 18 towns and cities which have little or no forest land, and therefore do not appoint forest wardens. On account of the large number of towns not reporting, we may be sure that the figures which we have are very conservative. The wardens reported that these fires damaged the woodland to the extent of $205,383. As we have emphasized in our previous reports, the figures for money damage are very inadequate, as many wardens will not report the damage, because they feel incapable of estimating it; and even when they try, they cannot set a value on the young growth killed and the gradual deterioration of the soil. In the cost of fighting fires, we have data which is not a matter of guesswork, although this is incomplete, because in towns and cities having an organized fire department, where the members are paid a regular salary, the cost of fighting woodland fires of course cannot be obtained. In 1905 the State Forester made a careful canvass of all the towns, and came to the conclusion that the annual cost of fighting fires was about $30,000. Our figures would seem to indicate that this conclusion was correct. When we spread this sum over the 300 towns in the State, it does not make a very large sum for each individual community; but it must be remembered that this expense is borne in large part by a few towns, and usually the poorest and least able to bear it. An annual bill of $1,000 for forest-fire fighting is a serious burden on a town whose entire yearly expenditure may not amount to more

than $15,000. This forest-fire menace is a two-edged sword, for, while it cuts its way into the town treasury, it is at the same time destroying the property which supplies the revenue to that treasury.

The present system of collecting fire reports in this office was inaugurated three years ago, and we thought that it would give opportunity for an interesting study if the data for 1908, 1909 and 1910 were placed side by side. Perhaps the most striking feature is the similarity in the totals for number of fires, acres burned and damage done. Looking at the table more closely, we find some interesting variations. For instance, the figures for March, 1910, greatly exceed those for March, 1908 and 1909. Spring came early last year, and the season of spring fires was present sooner than usual. There were comparatively few fires during the summer, although it was accounted a dry one. On the Cape, where most of the summer fires occur, they had considerable rainfall during July and August. The drought in October is reflected in the fire data for that month. The October fires were very severe, in that they burned in the peat and humus, many of them for weeks, and only severe rains extinguished them.

We find in the table of causes comparisons of more importance and interest. We find, for instance, that the number of fires caused by the railroads has steadily decreased, and we feel that this represents real progress on their part, although plenty of room is left for improvement. The number of fires caused by the burning of brush materially increased, and this would seem to be a cause for disappointment, in view of the general adoption of the present law; but owing to the provisions of this very law, which make it easier to place responsibility, it is the number of fires reported with this cause, and not the actual number of fires caused by burning brush, which have increased.

Fires caused by the careless use of matches in the hands of boys, fishermen, hunters, berry pickers, etc., have been the cause of more concern during the past year than ever before. Although the number under this head is not large, there is no doubt that most of the fires labelled "Unknown" would be placed in this column if they could be traced out; so that we

feel sure that they cause as many fires as the railroads, and are more dangerous, because the smoke is everywhere, while the railroad fire is confined to a certain district, and can be more or less anticipated. The time has not arrived when we can get a sweeping injunction prohibiting all smoking in the woods; but there is no doubt that by the necessary gradual posting of all private land against trespassing this condition will come in time.

As long as we have forest fires, there will be problems connected with them, and their solution will not come all at once; but there are certain features which can and should have immediate attention. In the first place, the office should have the services of a man whose entire time can be spent on forest-fire work. An assistant or chief forest warden, so called, would find a very considerable portion of his time taken up in carrying out the provisions of the fire-equipment reimbursement act; another portion would be well occupied in the collecting and listing of reports; and the remainder could be well used in visiting and assisting whatever forest wardens seemed to require such aid. If the Legislature should add to the authority of the State Forester other duties in the line of fighting fires and making arrests, this assistant would be a very busy man indeed.

Forest Fires of 1910.

Months.	Acres.	Damage.	Cost to put out.	No.
February,	5	–	–	2
March,	12,666	$57,740	$3,839	438
April,	13,782	68,867	5,125	413
May,	4,236	13,957	1,738	116
June,	137	980	490	23
July,	1,041	6,509	1,627	76
August,	165	1,275	763	44
September,	2,900	15,035	1,456	25
October,	7,068	40,064	7,885	196
November,	107	400	427	24
No date given,	114	556	125	28
Totals,	42,221	$205,383	$23,475	1,385

Comparative Causes of Forest Fires for the Past Three Years.

Causes.	1908.		1909.		1910.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Unknown,	314	24.4	360	25.1	413	32.9
Railroad,	494	38.3	497	34.7	362	28.8
Burning brush,	119	9.0	149	10.4	203	16.2
Smokers, hunters, berry pickers, etc.,	161	12.0	140	9.7	124	9.9
Steam saw-mills,	12	1.2	5	.5	1	.1
Children,	71	6.0	92	6.4	75	5.9
Miscellaneous,	118	9.1	190	13.2	78	6.2
Too late for tabulation,	–	–	63	–	129	–
Totals,	1,289	100	1,496	100	1,385	100

Comparative Damages by Forest Fires for the Past Three Years.

Months.	1908.		1909.		1910.	
	Acres.	Damage.	Acres.	Damage.	Acres.	Damage.
January,	–	–	13	–	–	–
February,	–	–	12	–	5	–
March,	236	$420	1,577	$4,763	12,666	$57,740
April,	16,262	52,731	12,515	72,195	13,782	68,867
May,	5,856	48,506	4,322	38,080	4,236	13,957
June,	1,195	17,824	405	11,870	137	980
July,	6,109	28,783	11,992	26,396	1,041	6,509
August,	1,567	22,320	1,940	10,833	165	1,275
September,	1,062	3,140	1,092	21,413	2,900	15,035
October,	7,084	29,960	384	1,805	7,068	40,064
November,	301	1,468	585	612	107	400
No date given,	–	–	246	1,515	114	556
Totals,	39,672	$205,152	35,083	$189,482	42,221	$205,383

Forest-fire Equipment.

The Legislature last spring passed an act authorizing the State Treasurer to reimburse towns, having a valuation of one and a half millions or less, 50 per cent. of whatever sum they might spend for forest-fire-fighting equipment, provided this sum does not exceed $500, and provided also that the equip-

ment purchased has the approval of the State Forester. As the law was not passed until after the time of the annual town meetings, only a few places have been able to avail themselves of its provisions, and but a small part of the appropriation of $5,000 was therefore expended. This appropriation, however, is a continuing one, and the same sum will be available next year. It is expected that many towns will vote this spring to spend money for this purpose. Wardens and selectmen of 17 towns have already assured this office that they will urge the matter at the next annual meeting. The following table contains the names of the towns that have received reimbursement, the amount thereof, and the kind of equipment purchased: —

Towns receiving Fire-equipment Reimbursement.

Towns.	Amount of Reimbursement.	Nature of Equipment.
Ashland,	$15 75	Johnson pumps and pails.
Boxford,	45 60	Chemical extinguishers.
Dighton,	58 67	Extinguishers and cans.
Georgetown,	39 39	Extinguishers, cans and shovels.
Greenwich,	25 95	Chemical extinguishers.
Hanson,	100 77	Wagon and other equipment.
Mashpee,	34 55	Extinguishers and shovels.
Middleton,	49 50	Extinguishers.
Norwell,	50 00	Extinguishers.
Oakham,	138 00	Extinguishers.
Pembroke,	203 75	Wagon, extinguishers, etc.
Phillipston,	48 65	Extinguishers.
Prescott,	48 16	Extinguishers.
Raynham,	50 00	Extinguishers.
Westminster,	55 91	Extinguishers and cans.
West Newbury,	24 00	Extinguishers.

In addition to the above list, the towns of Bedford, Charlton, Hanson, North Reading, Tewksbury, Sterling, Sandwich and Wrentham have already purchased equipment, the reimbursement on which will amount to $1,600; but, as their accounts were not received before November 30, we were not able to list

them in our table. All of these towns except Charlton purchased a full wagon equipment.

In this connection it is pertinent for us to call attention to our two model forest-fire wagons. These were built by the State Forester in order that the officials of the towns wishing to purchase forest-fire equipment may see what we consider an ideal form of apparatus. The plan of this outfit was made up only after a careful study had been made of existing forest-fire apparatus in several towns.

The larger wagon is intended for two horses, and costs, all equipped, about $450. The equipment consists of fourteen chemical extinguishers; fourteen galvanized cans, each holding two extra charges of water and chemicals; shovels; rakes; mattocks; and spare chemical charges. This equipment is carried in racks and cases, not only so that it will ride safely, but also so that it can be conveniently carried into the woods. Eight men can find accommodation on this wagon.

The smaller wagon, drawn by one horse, has all the equipment of the larger, but less in amount. It will carry four men, and costs, all equipped, about $300. These two wagons were exhibited this fall at the Marshfield, Barnstable, Worcester, Clinton, Barre and Palmer fairs, where they attracted general interest. The New Haven, Boston & Maine and New York Central railroads aided us in this exhibition work by transporting the wagons over their lines without charge. A small pamphlet describing these wagons has been published by this office, and may be had on application.

Forest-fire Deputies needed.

The State Forester wishes to repeat what was suggested last year under this head: —

> The forest warden law has undoubtedly been tested far enough to be pronounced a success as another step in perfecting our organized efforts against forest fires. I now propose the idea of empowering the State Forester to appoint deputies at large to assist him. Many of our forest wardens need instruction and co-operation in getting their work well in hand. The best way to teach these men just how to accomplish results in fighting forest fires is to confer with them right on the ground, and

demonstrate what can be accomplished and how it can be done. There are experienced men whom the State Forester could in times of emergency delegate to assist, and, if need be, with authority to take charge.

In the case of the gypsy and brown-tail moth agents, these men are at present mounted on motor cycles, and hence are familiar with the country. They are already State employees, and men interested in the preservation of the forests. They will gladly acquaint themselves with modern methods of fighting forest fires, and, were they appointed deputies authorized to assume responsibility, the State would have their services at no extra compensation. Of course this would apply only throughout the moth-infested territory, but other plans could be worked out for the remainder of the State at a minimum cost.

Disposing of the Slashings or Brush.

As a result of the discussion of this matter in the last annual report, the State Forester has had many inquiries and has discussed the matter with practical men. That the slashings left from limbing are a great menace, and one of the basal dangers causing forest fires, there can be little question. At the present time this office is carrying on some experiments to determine the expense of handling the slash, and the results are looked forward to with much interest. No one desires to hinder the wood-lot operator, or to cause him any extra expense; but when the expense of piling and burning the brush is once determined, it can be dealt with as a part of the business transaction. We must conserve for the future welfare of the town and Commonwealth, as well as for the present. It is high time, therefore, that some reasonable State regulations should be made.

Forest-fire Lookouts.

Last year attention was called to the value of forest-fire lookouts, and the advisability of our experimenting somewhat, to determine whether their use would be applicable to our conditions. We were unable to spare any of our regular appropriation for doing anything in this line; and hence, with the exception of the Plymouth tower, which was erected by the town of Plymouth a few years ago, there are no others in the State.

Since our last report New Hampshire has established several lookout stations, and the results derived from their first season's use are very satisfactory.

The slash remaining following the lumbering of a pine lot at Concord. Here is where we must guard against fire.

The brush or slash conditions following lumbering of a mixed growth at Petersham. This is typical of most sections, and forms the base or tinder-box that causes our destructive forest fires.

Maine has a number of these lookouts scattered throughout the so-called wild or forest lands, and the State makes an annual appropriation of $60,000 a year for these stations and for fire-patrol work. The work of the Forest Commissioner of Maine is primarily that of forest-fire protection.

New York has forest-fire lookout stations established throughout the Adirondacks, and values them very highly.

The point may be raised that the States named have a much larger forested area than has Massachusetts. This is true; but this State it quite thickly populated, and the dangers from fires are therefore proportionately greater, as man himself seems to be the destructive force. There is no doubt that the small outlay required for the services of men to attend a few lookouts at high points in this State, together with the installation of telephones, would have been repaid many times over during the past season in the saving of forest values by stopping fires in their incipiency. There is nothing like having a system for getting results. If this outlook plan could be added to the present forest warden system, it is believed that it would be an economic step in the right direction.

Fire Lines and Protective Moth Belts.

Each forest warden should plan to interest his town in doing something in the way of making fire lines. By making a beginning and doing a little each year the importance and value of the work will demonstrate itself. The widening of all wood roads or cleaning a strip and running plowed furrows, together with separating the débris, etc., if done in advance, precludes the danger from fires, so common at present. This winter this department has been fortunate in finding enough of this sort of work, largely on private estates, to employ a number of our men in making fire lines. By finding the men employment at this season, we shall be able to keep them the year round. Men familiar with the work and understanding modern methods accomplish much more than inexperienced men.

These fire lines may be utilized for operating the lots, as occasion demands; also, they enable one to combat the dreaded moth pests.

Railroad Co-operation in Forest-fire Fighting.

During the past season there have been many evidences of co-operative assistance on behalf of the railroads with the State Forester and the forest wardens in preventing and fighting forest fires. Invariably when assistance has been asked from the main office of the railroads or the local section men, it has been furnished. In one instance of a fire which had not been set by the railroad, a forest warden reported that twenty-five men in the employ of the railroad came to his assistance without making any charge to the town for their services.

There were many instances where engines were reported as evidently having inefficient spark-arresters, and hence they were throwing out cinders and setting fires; but it is believed that in each case they were overhauled and improved.

Certainly there is already a great difference in the feeling of our rural people towards the railroads; and this is equally true, we are inclined to believe, of the railroad people as regards the protection of our woodlands and forests.

When the State Forester came to Massachusetts, in 1906, it was the consensus of opinion that the railroads were the great offenders in burning up our forests. If there was a railroad in the vicinity of the fire, it was always held responsible. Since our forest warden and permit laws were enacted, and we have been enabled to get at the real causes of forest fires, it is plainly shown that there are many causes for forest fires other than the railroads. The railroad fires, however, are still very numerous, and there are great opportunities for improvement; but let our forest wardens in each town co-operate and work harmoniously with all forces toward getting better results in checking and eliminating forest fires. All we desire is to get the exact facts, and then we shall be in a position to better the conditions.

The railroad officials are business men, and can be convinced of their duties as readily as any class of people. Instead of a forest warden finding fault and getting disgusted over railroad fires, the thing to do is to get direct proof and evidence, by having the number of the engine, the time of day, the date, etc., and then taking it up with the proper authorities. One warden has succeeded in getting the railroad people to keep some barrels

filled with water on the right of way upon a bad up-grade which runs through woodland in his town. This same road has also supplied the section men on this section with two three-gallon hand extinguishers. Forest wardens little realize what they can accomplish until they try.

Power Sprayers as Forest-fire Equipment.

Attention was called in last year's report to the use of power sprayers in putting out forest fires. From our experience with the modern sprayers, which can be turned around in a small space, and hence may be readily handled, even in wood roads, they should be used more often. These machines can be adjusted to spray directly from the brook, pond or tank, so that they are adaptable for service when other equipment would be useless. If for no other purpose than to carry water, they can be made very serviceable, as they can be filled by their own power in about five minutes. The capacity of the tank is usually 400 gallons. As these sprayers are capable of throwing a stream to the top of the tallest trees, it is readily seen what a radius of fire could be reached and deadened by them. They have sufficient power to maintain a 300-pound pressure at the end of a 1,500-foot length of 1-inch hose. These same machines could also be used to great advantage for house fires in the country. As our towns need such a device for the protection of their trees, why not get all the good possible out of them?

Forest Fires in Germany.

A recent letter from Mr. F. B. Knapp, a Massachusetts man who is spending the year abroad with the Biltmore Forestry Schools, says: —

> They have practically no forest-fire problem here, and I should say that it is chiefly due to *respect for law and order.*

The State Forester appreciates the above statement, for it comes from a man who has shown much interest at home in these matters; in fact, he is the forest warden of Duxbury, where good work has been done.

State Subsidy to Towns for Forest-fire Protection.

The law enacted last winter, which assists all towns having a valuation of one and one-half millions or less in purchasing fire equipment to the extent of 50 per cent., or an amount not exceeding $500, was passed too late to be taken advantage of by most towns, as their annual town meeting had been held.

At the coming spring town meetings it is believed that many will accept the assistance. The State Forester has a brief pamphlet in press that will be sent to all towns in time for their consideration before the spring meetings.

Public Addresses.

As many engagements have been filled throughout the year as the State Forester could accept, and at the same time consistently carry on his other duties. The custom of placing the responsibility upon organizations of securing an audience of at least one hundred has made our efforts more effective and better appreciated. It has been practically impossible to meet all the demands from local clubs and private organizations; hence we have invariably requested that, in so far as possible, these meetings be thrown open to the public.

The usual course of lectures was given at the Massachusetts Agricultural College during January.

Lectures before Scientific Organizations.

The State Forester has had several requests to lecture outside the State, as well as at home, and the following were accepted: Lehigh University, Bethlehem, Pa., in their special lecture course on forestry; the New Hampshire Horticultural Society, annual meeting at Manchester; the Society for the Promotion of Agricultural Science, annual meeting at Washington, D. C.; the American Society of Economic Entomologists, annual meeting at Boston; the Economic Club; Williams College, at Williamstown; the Massachusetts Reform Club; High School Principals Association; the Society for the Protection of New Hampshire Forests, at Bretton Woods, N. H.; etc.

A plantation of white pine, thirty years old, at South Orleans, on the Cape. Who says white pine will not grow on the lower Cape?

State Firemen's Association.

The annual meeting of the State Firemen's Association was held at Lowell during the week beginning September 19, and the State Forester addressed the organization on Thursday evening, September 22, on the subject, "Forestry, and Fire Menace of the Same."

This organization has been ready to co-operate and assist the department at all times, and their good offices have been highly appreciated.

During the past summer, at a meeting of the officials of the above association and the State Forester, it was agreed that the fire-permit act should apply to cities as well as to towns.

Thinning Bulletin.

The bulletin by the State Forester's assistant, Mr. H. O. Cook, on "Thinning," referred to as being in press last year, was received from the press early in the year, and has proved of great value in assisting us in getting this information into the hands of those who contemplate improving their woodlands.

This bulletin is opportune, as it meets a definite place in the handling of woodlands in the worst moth-infested sections; and it helps not only in making better forestry conditions, but, with the poorer trees and dead wood removed, the work of spraying and treating woodlands is greatly simplified.

Bulletin on Reforestation and Nursery Work.

Reforestation and the growing of young trees is at present a subject of great interest to our people. In order to give detailed and exact knowledge, the bulletin was carefully planned and published, and we have every reason to believe that it covers the subject as clearly and as practically as any publication available. It was written by Mr. R. S. Langdell, assistant in charge of the State nursery at Amherst, who also has charge of the reforestation work throughout the State. We believe it hits the nail on the head, and is of great assistance in the State work.

The Chestnut Bark Disease.

This disease, as reported last year, does not seem to have caused any great amount of damage as yet in this State. We had received but one direct notice of its appearance here, when a letter came from Dr. Haven Metcalf, stating that he had reports of four outbreaks in Massachusetts. The State Forester has taken the matter up with Dr. Metcalf, and has also written to Prof. George Stone of the Agricultural College at Amherst. If occasion demands, further notice will be given, calling attention to the disease and showing how the infested trees should be treated.

The precaution mentioned last year will apply not only to the chestnut, but to all trees; namely, that any tree that becomes unhealthy, particularly in the woodlands or forest, should be removed, thus minimizing the danger.

Conference of State Foresters and Forest Wardens.

A meeting was held at Bretton Woods, N. H., during the first week in August, under the auspices of the Society for the Protection of New Hampshire Forests, at which various State foresters and forest wardens held a conference. The State Forester and many other Massachusetts people attended, including Mr. Guild, secretary of the Massachusetts Forestry Association, Congressman Peters, Forest Warden Knapp of Duxbury, etc. The meeting proved a very interesting and instructive one. The following paper was presented by the writer: —

The Massachusetts Forest Warden System.

Massachusetts has had the town forest warden system in practice long enough to feel that it is a pronounced success. The idea of having an authorized town, and, in a sense, a State official in each town who is clothed with sufficient power to get results in a broad forestry movement, makes a splendid nucleus for better future results.

It is the aim of the State Forester to secure for these positions public-spirited citizens who have their town interests as regards forestry matters at heart, and then get them all the assistance possible. When a man is broken in, the aim of the State is to retain him in the work.

The duties of the forest warden in Massachusetts are multitudinous, and he will never lack for things to do. The following are some of the forest warden's main duties: —

Interest in all forestry matters. Appointed by selectmen, subject to the approval of the State Forester, he has the power to appoint and discharge deputies. State Forester's power to hold meetings for educating forest wardens. Forest warden chief forest fire fighter in the town. Forest warden source of information on reforestation in the town. Forest warden, ideas on thinning and pruning trees. Forest warden read or have read fire laws in schools. Forest warden post fire laws and warnings. Forest warden deal with railroads in his town. Forest warden have ideas on forest taxation. Forest warden assist State Forester on forest data, maps, etc. Forest warden tell when seed and seedlings are plenty. Forest warden start a town nursery. Forest warden, amount, kind and price of cheap lands. Forest warden, town lands accepted and planted. Forest warden encourage forestry in town schools, grange, farmer's clubs, woman's clubs, etc. Forest warden handle town insect troubles. Forest warden assist in encouraging beneficial birds. Forest warden plan fire campaign, fire belts, have fire extinguishers well placed, telephone calls, etc. Forest warden, power to arrest without a warrant within certain restrictions, etc.

The whole purpose, as I see it, is to adopt modern ideas and systematize our efforts along well-defined channels, whereby results are made possible. The working out of a forest warden system in a thickly settled State like Massachusetts might not adapt itself to some sections of Maine and northern New Hampshire, but with modifications it could be made to do so. In Massachusetts about 5 per cent. of the forest products used are grown in the State; hence we have a good market, and with modern methods of forestry management, made possible through local and State officials, the value from possible forest products can be made very great. What is true of Massachusetts is equally true in other New England States in more or less degree.

Expenditures and Receipts.

In accordance with section 6 of chapter 409 of Acts of 1904, as amended by Acts of 1907, chapter 473, section 2, the following statement is given of the forestry expenditures for the year ending Nov. 30, 1910: —

Forestry Expenditures.

Salaries of assistants,	$5,346 47
Travelling expenses,	1,001 78
Stationery, postage and other office supplies,	369 37
Printing,	960 37
Instruments,	48 55
Forest warden account,	499 92
Nursery,	2,222 15
Sundries,	143 13
	$10,591 74

REFORESTATION ACCOUNT.

Seedlings,	$2,204 70
Land,	1,035 00
Labor,	5,124 68
Equipment,	694 63
Travelling,	670 83
Express,	311 21
Sundries,	57 74
	$10,098 79

Turned over to the treasurer for publications,	$102 60
Turned over to the treasurer for seedlings,	243 50
Turned over to the treasurer for cord wood,	118 13
	$464 23

Reimbursement to towns for fire-fighting apparatus,	$1,469 56
Unexpended balance,	3,530 44
Total appropriation,	$5,000 00

In accordance with section 5 of the above-named chapter, the following statement is given of the receipts for travelling and subsistence: —

LECTURES.

Mansfield Men's Club,	$1 00	Hingham Association,	$1 70
Andover Grange,	1 20	Massachusetts Board of Agriculture,	5 69
Newburyport Neighborhood Club,	30	Cornell Club,	1 50
Rockport Men's Club,	90	American Forestry Association,	25 00
Saugus Laymen's League,	1 10	Course of Lectures, M. A. C.,	—[1]
Littleton Women's Club,	1 42	Woronoco Club, Westfield,	5 40
Malden Board of Trade,	2 00	Newburyport Club,	3 00
Somerville Board of Trade,	20	Pilgrims' Club, New Bedford,	2 50
Bellingham Pomona Grange,	1 40	Williams College,	11 34
Foxborough Grange,	3 15	Middlesex Sportsman's Show,	1 04
Boston Public Library, Field and Forest Club,	3 00	Newton High School,	75
Quincy Men's Club,	5 00	Winchester Unitarian News Club,	1 96
Buzzards Bay,	2 40	South Bristol Farmers' Club,	3 00
Athol Improvement Society,	4 04	Worcester Horticultural Society,	—[1]
Bolton Pomona Grange,	1 50	Heptorean Club,	1 50
Boylston Grange,	2 50	Phi Delta Theta Club,	2 25
Fitchburg Pomona Grange,	2 28	Farmers' Week, M. A. C.,	—[1]
Harvard Grange,	1 84	Fish and Game Association,	—[1]
Phillipston Grange,	3 50	Palmer's Woman's Club,	4 00
Amesbury Improvement Society,	40	Winchendon Board of Trade,	5 00
Hatfield Men's Club,	5 00	Winchester High School,	1 21
Bristol County Academy of Science,	2 00	Barre Library Association,	4 48
		Danvers Bird Club and Grange,	1 25

[1] Paid.

LECTURES — *Concluded.*

Wellesley Grange,	$3 00	State Fireman's Association,	$3 50
Massachusetts Reform Club,	1 22	Hanover Fireman Muster,	1 50
Pepperell Woman's Club,	2 00	New Hampshire Horticultural Society,	5 50
Lehigh University,	24 31	Springfield Board of Trade,	5 00
Pierce School,	1 07	Roxbury Woman's Club,	2 00
Institute State Board of Agriculture,	7 45	Massachusetts Forestry Association,	—[1]
Grange field day, West Newton and Yarmouth,	10 59	Society for the Protection of New Hampshire Forests,	25 10
Montwait Chautauqua,	1 15	American Association of Economic Entomologists,	2 00
Cape Cod Cranberry Association,	2 20		
Franklin County Pomona Grange,	8 11		
State Prison teachers,	1 30		

[1] Paid.

EXPENSES INCURRED IN EXAMINATION WORK, CHARGED TO OWNERS.

Allen, P. R.,	$0 70	Main, F. H.,	$5 44
Bent, F. E.,	50	Massachusetts Agricultural College, Faunce demonstration farm,	5 00
Borden, N. E.,	74	Minns, Susan,	2 50
Boston & Northern Street Railway,	1 32	Minot, W.,	2 00
Brayton, A. P.,	2 00	Morey, E.,	1 00
Brochu, J. E.,	1 40	Nelson, H. W.,	1 20
Burnett, H., trustee,	70	Pickman, D. L.,	1 50
Chandler, F. F.,	62	Robinson, C. E.,	2 85
Cummings, W. O.,	62	Sawyer, A. H.,	1 50
Cushing, J. S.,	50	Sears, Julia M.,	1 40
Dewar, D. W.,	1 25	Seavey, H.,	50
Eddy, Mary B.,	15	Simmons, H. F.,	1 25
Emerson, Dr. N. W.,	18	Stevens, E. A.,	1 50
Forrest, W. P.,	1 00	Stevens, H. H.,	1 14
Fowle, D. H.,	1 80	Stone, G. (W. Manning),	2 35
Fuller, W. A.,	1 50	Tenney, C. H.,	1 16
Gerrish, Isabel F.,	1 00	Tracy, Harriet E.,	2 85
Green, F. C.,	2 40	Webber, F. S.,	3 05
Harriman, C. S.,	68	White, J. H.,	1 20
Horne, W. N.,	90	Fitchburg Water Board,	2 00
Hunnewell, H. H.,	50		
Jones, J. L.,	1 20		
Lawrence, I. P.,	6 50	Total,	$71 37
Mahoney, T. J.,	1 82		

EXPENSES INCURRED IN SUPERVISION OF MANAGED WOODLANDS, CHARGED TO OWNERS.

F. C. Green,	$4 80
R. B. Symmington,	20 00
	$24 80

EXPENSES INCURRED IN GIVING INSTRUCTION IN PLANTING, CHARGED TO OWNERS.

E. P. Joselin,	$2 35
Long Island, transportation furnished,	—
Fitchburg Water Board,	4 85
Needham Water Board, no expense,	—

Part II.

GYPSY AND BROWN-TAIL MOTH SUPPRESSION.

Part II.

GYPSY AND BROWN-TAIL MOTH SUPPRESSION.

Conditions in 1910.

The moth work during the past season has gone forward with more precision and earnestness than ever. The year's results have been very encouraging, in spite of many negative conditions.

First, in January there was a heavy fall of snow over all the infested territory, which lasted in many localities, especially on some private estates, until late in the spring. In these places, where the cleaning had not been done previous to the snowfall, it was impossible to do thorough work before the caterpillars began to hatch. These conditions prevailed where property owners had neglected to care for their property. Next, in the spraying season the work was hampered to a great extent by cold and rainy weather in June. The growth of the foliage was practically at a standstill, while the caterpillars continued to develop. Much good and effective work was done, however, and the results were better than the climatic conditions gave us cause to expect.

Burlap and tanglefoot were not used as much during the summer of 1910 as previously, but the results obtained have been nearly as good. While it may seem in looking over the territory that the infestation was more severe than in 1909, because no burlapping was done, yet, setting against the expense of the burlap, putting it on and tending it, the expense of treating the egg clusters left in the winter, the cost of caring for an infested area will be seen to be considerably less, the infestation in nearly all residential sections being now very light.

Where spraying is done effectively on street trees and on contiguous property, it is not economical to burlap also. If burlap could be used, and only turned once or twice, say about the time caterpillars are pupating, the results might pay; but where they are tended during the whole caterpillar season, the results do not warrant the expense. Tanglefoot has been used mostly in orchards, small wooded areas or in protective belts, and is economical thus used.

Spraying in residential sections against the gypsy and brown-tail moths has been confined mostly to wooded roadsides, private property and small wooded areas, where the infestation menaced orchards or shade trees. The greater part of the spraying which has been done on street trees this year has been done against the elm-leaf beetle, and paid for locally out of appropriations for the purpose; the moth department allowing cities and towns to use apparatus belonging to them in the fight against the beetle, as we believed that some benefit to the moth work might accrue in the spraying of the trees. This was where the gypsy moth infestation was so slight as not to warrant spraying for it alone.

Scouting.

In the known infested district the scouting for gypsy and brown-tail moths has been mostly done by the city and town gangs. But little scouting was done except in towns where the infestation was light. In the new territory, that is, in towns bordering on those known infestations, scouting has been done by the government employees. This work has been of great help to this office and to the moth work in general.

Scouting done by town or city gangs in newly infested places is not apt to be very thorough, as the men are for the most part inexperienced, have seen but few gypsy moth egg clusters, and are liable to miss infestations, which thus remain unknown until they become severe enough to attract the attention of the novice. If this work is done by experienced men, much better results are obtained.

In towns where the infestation is very light, it requires but a part of the year to do the necessary work; therefore, there is no permanent employment for a gang of men, and it is not

Before thinning, at Manchester-by-the-Sea. Imagine the difficulty in treating this woodland for gypsy moths as it is.

After thinning, at Manchester-by-the-Sea. Not only are the conditions better for combating moths, but the improved forestry conditions are evident. Further, the cordwood helps to meet the expense.

possible to train them and have an experienced force. If the law under which we are now working were so amended that the State Forester might carry on the work in several towns adjoining each other, where the infestation is of a similar character, and employ a steady force of men to do the necessary work, much better results could be obtained. In order to employ good, steady, faithful men, they must be given fairly permanent employment; and in any business where good results are to be obtained, experienced men must be employed. The infestation in nearly all of our towns — we will say, for instance, a greater part of the towns in Worcester County — has started with colonies of but one or two egg clusters, and these have gradually increased, until in some of them hundreds and thousands and tens of thousands of egg clusters are now found. This should not have happened, and if the work might have been directed by, or taken up under the personal supervision of, this office, much better results would have been obtained. Until the infestation in cities and towns in what is known as the outer district becomes severe, so that the men employed in the work become better acquainted with the habits and appearance of the gypsy moth, efficient work, as a rule, is not accomplished. The agents and division superintendents who are employed by this office experience a great deal of difficulty in controlling the methods and plans of doing the work in such towns as mentioned above. But if a gang of men, for instance, were employed to do the work in five towns, the agents and division superintendents would only have to look after one town at a time, instead of five, and in this way supervision would be made easier. The best arrangement for this would be to have it optional with the State Forester as to the towns in which it would be necessary to do the work in this manner, and have it understood that the cities and towns where the work is to be done should be assessed for the work to the extent of their legal liability, payment to be made every sixty days. In most cases in sixty days all the necessary work could be done, generally in the fall and winter months; it would be necessary to make some expenditures in doing summer work, but not on as large a scale as in the months when the gypsy moth is dormant. On the

other hand, where this scouting is done by local inexperienced forces, the work must be inspected after them, and it means a double expenditure, — one by the town, and one by the State. This seems to us unnecessary.

If this work is done in the first place by competent men, very little inspection is necessary, — not more than an experienced foreman would be able to give to the work of the scouting gang.

The scouting done by the federal forces has disclosed new infestations in several towns. The following towns were scouted by them, and those marked with an asterisk were found to be infested: —

Ashburnham.*	Ludlow.	Warwick.*
Athol.*	Palmer.	Webster.*
Barre.*	Petersham.*	Winchendon.*
Brookfield.*	Rutland.*	Gardner.*
Charlton.*	Spencer.*	Orange.*
Dana.	Sturbridge.*	Paxton.*
Douglas.*	Uxbridge.*	Royalston.*
Dudley.*		

Spraying.

Spraying with arsenate of lead during the season of 1910 was done on a larger scale than ever before, nearly all residential sections being sprayed, the greater part of the infested private property, and more woodland than in any previous year, and the results obtained were satisfactory in nearly all places. More territory was covered in a shorter space of time than in any previous year. This was principally due to two causes: first, city and town forces were generally more experienced, and educational work could be eliminated; second, improved apparatus was generally used. It was mentioned in our last report that this office was conducting some experimental work in spraying apparatus, and the results of this work proved to be very helpful. The spraying machines which were designed by us were far superior to anything previously used. They were much lighter, and capable of maintaining more pressure than those used in the past seasons, and break-downs were so few that no inconvenience worth mentioning was experienced. The fact that these machines can easily be filled from ponds or

brooks was a feature of great importance, as much less time was wasted in this operation, — five to six minutes being about the usual filling time. Several times it was noticed that from the time of filling to the time when the gang began spraying again it was only eight or nine minutes, while in previous years the time of filling was eighteen to twenty minutes, and about twenty to twenty-five minutes was the usual loss of time in filling. Taking into consideration that from eight to eleven men were employed on each machine, and about twenty machines were used in the State, the saving with improved apparatus, in time alone, was a considerable one.

In discharging, some time was also saved, the usual time being twelve to fourteen minutes, although it was necessary for the men to work much faster than with the old apparatus. Twenty-three and one-half acres have been thoroughly covered in one day, and this was in heavy, high growth. In designing these machines, as they were costing us a high price, we were very particular that we should have good material in the apparatus. We bought extra good caravan running gears with wide tires, circular rocker plate, and cut under, so that the machines could be turned in their own length. No trouble was experienced during the whole year with any part of the running gear. Some were fitted with brakes, and some were without; but it has been decided that the brakes on the running gear are much needed in the general work. The pumps were formerly of cast iron and brass, but phosphur bronze was used in the new ones, which is a much harder metal. It will stand higher pressure, and therefore it is not necessary to have such large, bulky pumps, and this eliminates a large number of pounds in weight. Metal valve seats were used, instead of rubber. The four-cylinder engine was found much more effective, as it did the work more easily than the two-cylinder engine. A safe comparison is the difference between one horse drawing a two-horse load, or two horses drawing the same load. In the coming season it has been decided to use mechanical oilers, as the ones previously used were neglected by the engineers, and caused some trouble when engines were being started, as the crank base would have an over-supply of oil. Also magnetos will be used

in place of batteries, as about the only trouble we experienced in the past season was in adjusting vibrating coils, which were connected with the batteries. In using magnetos we feel that all trouble of this kind will be eliminated, and also the wiring, to a great extent. Batteries are liable to get wet, where so much water is being used, and in this way lose their strength.

The nozzle, which was also mentioned in the last report, has proved to be probably the largest money saver of any piece of improved apparatus which has been used in the field since the work began. When the machines are running all right, climbing the trees in order to spray the tops is not necessary; and in some cases all the street trees in a town or city were sprayed without any climbing whatever, by using a long nozzle. In the spraying of 3,000 acres of woodland, which was done under the supervision of this office, a saving of from $5,000 to $6,000 was made by the use of the new nozzle. Much better results were obtained, as in using an old nozzle oftentimes climbing was not done when it should have been, and the tops of the trees were not covered with poison. Later in the season this was very noticeable, as the caterpillars ate the unsprayed parts first. This was practically eliminated this year. Some difficulty was experienced in getting enough nozzles to cover the entire field at the proper time; but next season we hope to have enough on hand so that every power sprayer will be properly fitted with a new nozzle. In some towns towers on sprayers were also used in spraying street trees, but we do not find them as satisfactory as we hoped. Where there are trolley wires, especially, with these towers, it is necessary for the spray team to go very near the trees; and the force of the water goes too directly on to the leaves, and a strength of poison sufficient to kill the caterpillars does not remain. This fact has been noted several times in the solid-stream spraying; but in looking over the field during the past season we find that the same trouble still exists in some cases. It must be borne in mind at all times, when spraying is being done with solid stream, that the operator of the nozzle must stand a sufficient distance from the tree so that the solution will reach the foliage in as near a mist form as possible.

In a greater part of the district nearly all spraying is now being done with the solid stream, although some cities and towns

Our new power sprayer complete. This outfit was planned and built by the State Forester's department. Four-cylinder engine, triplex bronze pump, 300 pounds pressure capacity, weight 3,000 pounds.

still believe that it is necessary to use the mist spray and small hose, and climb trees. This method of work should be eliminated as fast as possible, as it has been proved conclusively that in a very large part of the street tree and orchard work solid-stream spraying is more effective, more economical, and larger areas are covered in less time, — time being one of the chief assets in the spraying season.

Another feature connected with spraying which must be guarded against in the future is the mixing of arsenate of lead in the barrel. When it is first opened, that is, before any of the material is weighed previous to putting it in the tank, it should be properly stirred and equally mixed. We have found it to be a fact that there is a much weaker solution at the top of the barrel than at the bottom; and if the poison is not stirred in the barrel, before using, the results are poor, from the use of the weaker poison. This insufficient mixing of the arsenate of lead is often the cause of uneven results of spraying; and it is hoped that before another caterpillar season some mechanical method may be applied to mixing the poison. However, if this should not be perfected at that time, more care must be used in stirring the poison by hand.

The fullway coupling, which we used this last season, did not prove as good as we hoped. The marline cover would not hold in under the coupling, although we received the benefit of the waterway, and do not feel that anything was lost by the use of this coupling. Probably with the improved sprayer in the coming season better agitation will also be possible, as new agitators will be used. We hope that those in charge of the work will be in readiness to start next year with the spraying apparatus in perfect condition, so that no break-downs or obstacles of any kind may hinder early spraying; as we find that it is much more effective when done early than when it is done late in the season, when the caterpillars are larger, as they then do not confine their eating to one place as steadily as when young.

This office not being able to furnish all towns with power sprayers during the season of 1910, the use of travelling sprayers belonging to this office was introduced, and excellent results were obtained. The worst infestations in different

towns and cities were sprayed, and it is hoped that during the season of 1911 several more sprayers will be added to the number. In the following cities and towns the travelling sprayers were used: Malden, Melrose (Pine Banks Park), Woburn, Burlington, Billerica, Hamilton, Ipswich, Topsfield, Boxford, Georgetown, Rowley, Newbury, Andover, Tewksbury, Methuen, Wayland, Natick, Sudbury, Acton, Littleton, Westford, Tyngsborough, Townsend, Marshfield, Kingston, Carver, Middleborough, Cohasset, Norwell, Scituate and Waltham. They were also used on the North Shore at the last of the season.

Future Work.

In view of the fact that so much good work has been accomplished in the thickly settled sections, and conditions are much improved, it will be necessary in the future to eliminate some of the methods previously used in such sections, and use the money thus saved in other districts. The creosoting of gypsy moth egg clusters must be generally done the same as before, and the removing of brown-tail webs where absolutely necessary; but in some sections, where conditions are good, spraying may be omitted. By this method, towns and cities will be able to do work in other sections where it has not been possible in the past to do thorough work. Some of these sections are as follows: brush near stone walls on roadsides, where a continual infestation is found on the street trees in the vicinity. This does not apply to wooded roadsides, but to open country. Decayed orchards, where tinning is needed and worthless trees are to be removed. This work will prove very beneficial in the future, as it will help make the work done on private property of more effect, preventing reinfestation. Also, work should be done on some small wooded areas, which are a menace to adjoining property; here creosoting and spraying should be done. When spraying is being done in places which have been cleaned thoroughly in the past, especially in orchards, arrangements should be made with the owners to have the same paid for, owing to the great amount of benefit to the orchard, not only by the destruction of the gypsy and brown-tail moths, but by the improvement in the fruit in general, its marketable price advancing enough to more than pay for the spraying.

Supply Store.

On Dec. 1, 1909, this office opened a supply store, and such supplies as are used in the moth work were furnished cities and towns receiving reimbursement from the State. With few exceptions, it has received the highest commendation from those engaged in the work. The matter was also gone over with the State supervisor of accounts and State Auditor, and met with their complete approval. All supplies were purchased through public estimate, and the lowest prices were obtained. Arrangements were made with the successful concerns, that such supplies as might be needed during the season would be furnished at a uniform rate. Supplies to the amount of about $86,000 have been purchased, of which $68,103.58 has been furnished cities and towns. The average saving in general supplies has been $12,028.72, this being a very conservative estimate. The general saving has been about 17 per cent.

Not only has our supply store been used for the supply business, but it has been used in assembling power sprayers and power pumps and storing fire wagons, and, as it is centrally located, it has been convenient for parties wishing to examine wagons. The supply store has been one of the many advances made in this year's work, not only from a financial standpoint, but in efficiency of the work. In nearly all lines better material has been furnished. Previously, a great many towns doing moth work did not have the necessary tools, and were continually getting out of supplies, thus necessitating that the local superintendent spend some time in purchasing supplies, and, in a great part of the towns, visit Boston for the same, not only losing his time in the field, but having the additional expense of car fares. This has been practically eliminated; also, the local dealers did not always carry in stock such supplies as were needed, and long delays were occasioned. This very rarely happens under the new system.

Method of Ordering Supplies.

The local superintendent of each town is furnished with a catalogue, also with duplicate order blanks. He makes out orders and forwards them to the agent or division superintendent in charge of his district, for his approval. The agent then forwards the order to the supply store, where it receives immediate attention. The improvement in the equipment in the field is very noticeable, particularly in the increased use of hand carts. There are five times as many in the field as a year ago, making a large saving in horse hire, this having been a large item in the past. It has been our aim to furnish first-class material, and whenever supplies have not been satisfactory, the matter has been investigated at once, and such things as were needed have been procured. The saving which has been made in the new system has enabled us to do more work in towns which are being reimbursed. Another feature of the supply store is that it has been used for repairing motor cycles, where a considerable saving has been made, approximately 33⅓ per cent. We have several mechanics employed in assembling power sprayers and repairing sprayers in the field. This has proved very helpful and very economical. Nearly all of the power outfits in towns will be overhauled this winter by these men, that they may be in readiness for work when needed next season. A large per cent. of saving will be made next season, owing to this year's experience, as we have been able to discover several ways where money may be saved. We hope that whenever the town or city officials have suggestions to make, they will make them to this office at once, that we may consider them and see if they may be of use to us. When tools or supplies are not satisfactory, the fact should be brought to the attention of this office at once. In making out orders, it is hoped that local superintendents will be careful not to make mistakes, as the inconvenience is not only to them in the field work, but also to the supply store. The following is the list of supplies carried in our supply store. These supplies are furnished to towns receiving reimbursement only, nothing being sold to other towns or cities, or to the general public.

LIST OF SUPPLIES BY NUMBER.

No.
1. Arsenate of lead, 600 lb. barrel.
2. Arsenate of lead, 100 lb. kegs.
3. Axes, handled, 31" handle, 3¼ lb.
4. Axes, with handle, 31" handle, 3½ lb.
5. Axes, with handle, 31" handle, 3¾ lb.
6. Axe handles, Hopkins, oak 31".
7. Axe wedges, malleable iron.
8. Bolts for Waters pruners.
9. Brushes, extra, for poles.
10. Brushes, hand.
Brushes, wire, for crushing caterpillars: —
11. No. 1 Brophy improved.
12. No. 2 Lexington.
13. No. 3 Stoneham.
14. No. 4 Fells.
15. No. 5 Brophy.
16. No. 6 McCullough.
17. No. 7 Reading.
18. Brushes, pole, 12'.
19. Brushes, pole, 16'.
20. Burlap, 8".
21. Burlap, 10".
22. Bush hook handles, hickory, 32".
23. Bush hooks, handled.
24. Bush scythes, heavy.
25. Bush scythe loops and nuts.
26. Bush scythe snaths, heavy.
27. Bush scythe wrenches.
28. Cans, ¼ pt., twin brush.
29. Cans, pint, brush.
30. Cans, varnish (nozzle top), 1 gal.
31. Cans, oil, 1 gal.
32. Cans, gasolene, 5 gals.
33. Cans, creosote, 5 gals.
34. Cement.
35. Chains, 6' stake.
36. Chisels, heavy, 1½" socket firmer, plain edge.
37. Chisel handles, extra.
38. Climbing irons, Dicky, 16".
39. Climbing irons, Donnelly, 16".
40. Climbing irons, Lineman, 16".
41. Climbing iron pads.
42. Climbing iron plugs and rivets.
43. Climbing iron straps with buckles.
44. Coal tar.
45. Cotton waste.
46. Cork stoppers for pint cans.
47. Coupling, full-way, for 1" hose.
48. Coupling, long-tailed, for ½" hose.
49. Coupling, long-tailed, for ¾" hose.
50. Coupling, long-tailed, for 1" hose.
51. Coupling, long-tailed, for 1½" hose.
52. Creosote.
53. Dry batteries, small, No. 6.
54. Dry batteries, large, No. 7.
55. Dry batteries, special, No. 8.
56. Emery cloth, fine.
57. Faucets, ¾" cast iron.
58. Faucets, 1" cast iron.
59. Ferrules for Clyde pruners.
60. Files, 3-cornered 6" slim taper.
61. Files, flat 8".
62. Fork handles, for manure fork No. 44.
63. Forks, long-handled manure, No. 44.
64. Gas, carbonic, for gas sprayers, in 50-lb tubes.
65. Gasolene.
66. Gauges, pressure.
67. Gas, carbonic, for gas sprayers, in 20-lb. tubes.
68. Glasses, extra, for mirrors.
69. Gouges, 1½" socket firmer.
70. Grease, axle.
71. Grease, hard, for pump cups.
72. Grindstones, bi-treadle, ball-bearing.
73. Grindstone, extra.
74. Hammers, No. 12, Maydole.
75. Handcarts, 44 x 30.
76. Hatchets, lathing.
77. Hatchets, 1 lb. axe-shaped.
78. Hose, ½" cotton hose.
79. Hose, ¾" cotton hose.
80. Hose, 2½" cotton, for hydrant.
81. Hose, 2½" suction hose.
82. Hose, 1" 7-ply rubber imitation marline covered.
83. Hose, 1½" 4-ply imitation marline covered.
84. Hose, ¾" oil.
85. Hose reducers, 1½" x 1".
86. Hose reducers, 1" x ½".
87. Hose spanners.
88. Hose menders, ¾".
89. Hose connection, ½" Y.
90. Hydrant gates.
91. Jute twine for burlapping.
92. Knife screws for Waters pruners.
93. Knives, burlap.
94. Knives, cleaning.
95. Knives, sailors, sheath and belt.
96. Knives for telegraph pruners.
97. Knives for Waters pruners.
98. Ladders, extension, 20'.
99. Ladders, extension, 22'.
100. Ladders, extension, 24'.
101. Ladders, extension, 28'.
102. Ladders, extension, 34'.
103. Ladders, extension, 38'.
104. Ladders, extension, 40'.
105. Ladders, straight, 10'.
106. Ladders, straight, 12'.

List of Supplies by Number — *Continued.*

No.
107. Ladders, straight, 15′.
108. Loops, extra, for 3′ 1-man cross-cut saw.
109. Mallets, hickory, ½ lb.
110. Marline No. 8.
111. Mirrors, 2 x 4, with handle.
112. Nails ¾″ barbed roofing.
113. Nozzles, single vermorel.
114. Nozzles, duplex vermorel.
115. Nozzles, triplex vermorel.
116. Nozzles, Bordeaux.
117. Nozzles, 6′, for woodland work.
118. Nozzles, hose pipe screw, 10″.
119. Nozzles, hose pipe screw, 15″.
120. Nozzles to fit 1″ hose, 15″ long.
121. Nozzles to fit 1½″ hose, 18″ long.
122. Nozzle tip, ¼″.
123. Nozzle tip, 3/16″.
124. Nozzle tip, ⅛″.
125. Oil-burning outfit.
126. Oil, burning.
127. Oil, cylinder.
128. Opera glasses.
129. Padlocks, 2″ Yale, No. 853.
130. Pails, heavy galvanized iron, 14 qt.
131. Pails, creosote.
132. Paint, white.
133. Pitchforks, 4-tine.
134. Pliers, Barnard side-cut, 7½″.
135. Poles, bamboo, 12′.
136. Poles, bamboo, 16′.
137. Poles, spruce, for telegraph pruners, 18′.
138. Poles, spruce, for telegraph pruners, 20′.
139. Poles, spruce, for telegraph pruners, 24′.
140. Poles, window brush.
141. Pruners, No. 2 Clyde.
142. Pruners, extra handles for No. 2 Clyde.
143. Pruners, telegraph, with pole, 18′.
144. Pruners, telegraph, with pole, 20′.
145. Pruners, telegraph, with pole, 24′.
146. Pruners, telegraph, without pole.
147. Pruners, Waters, with spring for removing brown-tail webs, 12′.
148. Pruners, Waters, with spring for removing brown-tail webs, 14′.
149. Pruners, Waters, with spring for removing brown-tail webs, 16′.
150. Pruning shears.
151. Pump packing; designate pump.
152. Rakes, fire, long steel shank, 14 tooth.
153. Rope, Manila, for extension ladders.
154. Rope, Manila, 1″.
155. Rope, Manila, 1½″.
No.
156. Rope, Manila, for telegraph pruners.
157. Rope, cotton sash.
158. Rubber packing for face plates on Douglas pump; give size.
159. Rubber valve seats for pump; designate pump.
160. Saws, Disston, 3′ 1-man cross-cut, Great American Tooth.
161. Saws, Disston, 26″ No. 7, 5-point.
162. Saws, 5′ 2-man cross-cut.
163. Saws, 6′ 2-man cross-cut.
164. Saw handles for No. 7, 26″ 5-point Disston.
165. Saw handles for 3′ 1-man Disston.
166. Saw handles for 6′ 2-man cross-cut saw.
167. Scales for weighing arsenate of lead.
168. Scraper's barbox.
169. Screw eyes for telegraph pruners.
170. Screw drivers, 6″.
171. Scythe stone, Norton emery.
172. Snips, tinning.
173. Shovels, long handled, round point.
174. Shovels, square end (fire shovels).
175. Spark plugs.
176. Sprayer-barrel outfit.
177. Sprayer, double-acting pump and tank.
178. Spray poles, ½″ galvanized 8′ iron, fitted.
179. Springs, extra, for Waters pruners.
180. Springs for telegraph pruners.
181. Strainers for 1½″ suction hose.
182. Strainers, for 2″ suction hose.
183. Strainers, for 2½″ suction hose.
184. Tanglefoot, 25 lb. tins.
185. Tanglefoot, 40 lb. wooden pail.
186. Tanglefoot, ½ barrel.
187. Tanglefoot combs.
188. Tape, electric, ¼ lb. roll.
189. Tape, electric, ½ lb. roll.
190. Trowels, 7½″ brick.
191. Trowels, pointing 5″.
192. Washers, for 1″ suction hose.
193. Washers, for 1½″ suction hose.
194. Washers, for 2″ suction hose.
195. Washers, for 2½″ suction hose.
196. Washers, for 1½″ hose.
197. Washers, for 1″ 7-ply marline-covered hose (for new coupling).
198. Washers, for 1″ 7-ply marline-covered hose (for old coupling).
199. Washers, for 1½″ 7-ply marline-covered hose (for old coupling).
200. Washers, for ½″ cotton or rubber hose.
201. Washers, for ¾″ cotton or rubber hose.

List of Supplies by Number — *Concluded.*

No.
202. Wedges, steel, 4½ lb. Truckee.
203. Wrenches, bicycle, 8″.
204. Wrenches, monkey, 12″.
205. Wrenches, Stillson, 14″.
206. Zinc, sheet, 9 oz.
207. Memorandum books.
208. Monthly report sheets.
209. Pay roll blanks.
210. Record books.
211. Schedule of bill blanks.
212. Time books.
213. Triplicate books.
214. First Annual Report of Superintendent for Suppression of Gypsy and Brown-tail Moths.
215. Second Annual Report of Superintendent for Suppression of Gypsy and Brown-tail Moths.
216. Third Annual Report of Superintendent for Suppression of Gypsy and Brown-tail Moths.
217. Fourth Annual Report of Superintendent for Suppression of Gypsy and Brown-tail Moths.
218. Bulletin No. 2.
219. Sixth Annual Report of State Forester.
220. How to make Improvement Thinnings.
221. Reforestation in Massachusetts.
222. Massachusetts Wood-using Industries.
223. We must stop Forest Fires.
224. Forest Mensuration of the White Pine.
225. How and when to collect White Pine Seed.
226. Forestry in Massachusetts.
227. Forest Laws.
228. Parasite Bulletin.

Supplementary List, Oct. 19, 1910.

No.
229. Axes, broad.
230. Axes, hand.
231. Battery connections.
232. Beetles (state size).
233. Blade holders for bush scythes.
234. Bramble scythes.
235. Chisels, ¾″ flat.
236. Chisels, 2″.
237. Clyde pruner No. 2 bolts.
238. Clyde pruner No. 2 rivets.
239. Copper wire on spool.
240. Gage glasses.
241. Gaskets, copper.
242. Gasoline tunnel with strainer.
243. Gouges.
244. Handles, extra, for bush scythes.
245. Hose mender bands, ½″, ¾″, 1″.
246. Hose menders, ½″, ¾″, 1″.
247. Ladder, slip (made by Moulton).
248. Oilers, copper, for machinery.
249. Packing, flax.
250. Packing, Selden's.
251. Saw clamps with 1″ jaw.
252. Saws, two-edge pruning.
253. Scrapers, 3-cornered.
254. Strainers for lead.
255. Switch keys.
256. Tinning snips, curved blades.
257. Tunnels, small.
258. Waters pruner handles, extra.
259. Wrenches, monkey, 24″.
260. Wrenches, Stillson, 18″.
261. Wrenches, Stillson, 24″.

Co-operation.

Co-operation between this office and cities, towns and property owners is greatly to be desired, and is encouraged by this office. In cities already heavily burdened with expenses there are often public parks badly infested, where some co-operative arrangements might be made with this office, so that the expense of the work may be lightened for the city. It would be necessary to confine such arrangements to places most used by the public. This might also be done in large towns having public parks.

The problem of the individual is somewhat different, as troubles are usually confined to their own estates or to adjoining ones; but in either case, if the property owner shows a disposition to care for his estate in the proper manner, and he is the owner of valuable wooded areas, oftentimes better results can be accomplished by making some co-operative arrangement with this office. In cases where valuable woodlands are badly infested, the work of cleaning them should not be delayed too long, as each year they will depreciate in value, making the work more expensive. It must also be borne in mind that thinning, where there is not too much dead wood, oftentimes will nearly pay for itself in the cord wood that is removed, and also give the remaining growth a much better chance to mature. Where individuals clean their own property, and adjoining lands are badly infested, and the owner is unable to care for such parts as may border on his neighbor's lands, some co-operative plan should be arranged to meet the case. In spraying, it is also a benefit to have spraying apparatus used in cities and towns for the moth work and elm-leaf beetle work. We are willing to co-operate in any of the above-named ways; but cases should be brought to the attention of this office at the beginning of the year, so that there may be sufficient time to plan the work.

In purchasing extra spraying outfits which may be used in the future in spraying for the elm-leaf beetle, as well as in the work against gypsy moths, we are willing to co-operate with towns or cities.

This co-operative work is of value not only to the individual, but also to the community at large and therefore to the Commonwealth.

National Aid.

The work done by the federal forces during the year 1910 has been very commendable. The roadside thinning, which has been done by them this season in cities and towns where the infestation was severe enough to cause stripping of trees and dropping of caterpillars, has been a great help. Since the thinning and cleaning have been confined to a 50-foot strip, a greater number of miles have been covered than in previous years; and before another caterpillar season such roadsides as can properly

be treated by them will be nearly covered. We do not wish it understood that no more aid along this line will be needed; but the point that must be considered is, if this kind of work is nearly completed, what is the next most necessary step. It is generally understood by those best qualified to judge that national aid must be rendered us, with more definite purpose and by methods surer of results than ever before. According to the amount of infestation at the present time, Massachusetts is receiving less in proportion than any other State which is infested with the gypsy and brown-tail moths. Massachusetts' appropriation is $300,000; the cities and towns spend $350,000 and the tax which property owners pay amounts to from $150,000 to $200,000, making a possible expenditure of $850,000, not including what is being appropriated and expended in State parks and on the lands of State institutions, which would amount to nearly $200,000 more, this making an expenditure which can be estimated of $1,000,000 in all against the moths in the State. There is also a very large amount expended each year by individuals, of which there can be no record obtained, which shows that the government expenditure for New England in the fight against the gypsy and brown-tail moths, which is $300,000, is about one third of what Massachusetts is expending; and, as there are three other New England States with serious infestations of the gypsy moth, Massachusetts gets but a small part from the government, compared with what it should get. A tabulation of the expenditure of this money, which follows, reveals the exact condition. Maine expenditure from 1905 to January, 1910, $95,000; government, $50,000; New Hampshire, $37,000; government, $90,000; Rhode Island, $33,000; government, $38,000; Massachusetts, from May, 1905, to January, 1910, $5,500,000; government, $417,763.84.

After considering this analysis of moth expenditure in the New England States which are infested with the gypsy moth, it does not seem that Massachusetts, with its long, hard fight against this pest, and with its enormous expenditure, is getting its share of assistance from the government funds: that is, if the question of proportionate expenditure be taken into consideration. This work, from the time of starting in 1906, has been carried on with the purpose of controlling the spread of

the gypsy moth by the method of thinning wooded roadsides where bad infestations were found, and caring for the same throughout the year. This method seems to be the best up to the present; and, as before mentioned, probably before another caterpillar season a greater part of this work will be covered in this State. As it has also been determined that the spread of the gypsy moth is not alone brought about by artificial means (as is explained in another part of this report), some other means of assistance is due this Commonwealth. In other States, when the appropriation has been exhausted, the State forces have been taken on to the government pay roll and the work continued along the same lines. It often happens in our Massachusetts work that there is not sufficient money to carry out what might be termed necessary work; and when our funds are exhausted, there are no means for continuing until another appropriation from the State is available. This handicaps our work badly; and if we are obliged to allow men to lie idle any length of time, they immediately secure employment with the government forces, and when our money for the work is available it is necessary to take untrained men, which is a loss in efficiency and expense. It therefore seems to us that some more definite plan should be made, so that we should receive our proportionate share of the federal appropriation. Although our infested territory is not growing much larger, it is becoming more badly infested in the northern section of the State, as the gypsy moth is inclined to spread in this direction, thus necessitating larger expenditures by the State in this section; and, as the residential section in most cases is in much better shape, more attention is being paid to the infested woodland by the owners, and co-operation is asked for. With the limited appropriations which our State is able to make, this becomes a very severe hardship financially, and in these cases help from the government funds is needed. In order to supply the demand for help along this line, larger government appropriations should be made, with the stipulation that part of the money should be spent in this co-operative work with the State. Another reason why larger government appropriations are needed is, that inspection of shipments of all kinds is required to prevent the spread of the gypsy moth; and, as this problem is one

of great magnitude, if done on a large scale it will necessitate a large expense in itself. To result satisfactorily, it must be done in a very thorough manner.

On examining the analysis of expense, it will be seen that the other States are receiving larger sums in comparison to their expenditure than Massachusetts; and when the question is raised as to why this is done, the argument is used that their valuation will not allow them to make sufficient appropriation to carry on the work. Let us take our own case and look into it thoroughly, and see if we are not in the same class as the others, or worse. For twelve years previous to 1900 the State continued to appropriate money for this work. It was then stopped and taken up again four and one-half years later with larger appropriations than ever, and at that time a law was enacted so that the burden of expense was placed on the Commonwealth, cities, towns and property owners. They have stood the financial strain in an uncomplaining manner, while in other States, cities, towns and property owners are not suffering from this burden to any extent. As the law in our Commonwealth allows only a small moth tax to be placed on valuable wooded areas that promise to be ruined unless given treatment, it seems that the expense of this work should be shared by the government. As the cities, towns and State can do only a very small part of this work, to our minds this problem is becoming more and more of national consequence. Taking the badly infested sections into consideration, the westward border of our infested district is one of great importance, not only for this State, but to the whole country; and as time goes on, and the infestation increases in this section, the more the country west of us is threatened. If this pest ever passes the Connecticut River in our State, the States west of us are sure to become infested in time, and then the possibilities of control are almost beyond reason; while at the present time, if the proper methods are used, the chance of this westward spread is very small. While this Commonwealth is compelled to act under the present statute, it is powerless, as we cannot employ trained men and do the work as it should be done, as each town is doing its own work with what might be termed "untrained" men. On the other hand, if sufficient government funds were available, this

district could be thoroughly handled in the proper manner. It is therefore self-evident to one who understands the problem that the government appropriations are only one-third large enough; and it should be the duty of the people of our State and adjoining States to make an appeal to Congress for sufficient money to do enough work for more effective protection.

North Shore Work.

The work on the famous North Shore has been continued throughout the year. It is certainly fortunate for this section of the State that it contains such a public-spirited class of people.

The towns and cities represent one party and the North Shore fund raised by private subscription another, while the State is a third party. By all three interests uniting and having the work under the State's jurisdiction, we are able to accomplish exceptionally fine results. This North Shore work has proven especially valuable as an object lesson in demonstrating what can be accomplished.

The following is a partial reproduction of the summer residents committees' report: —

Gypsy Moth and Road Work on the North Shore.

General Purposes.

This circular is sent to outline the work which has been done on the North Shore during the last year, to preserve the forests and beautiful wooded drives and places, to develop its beauties by building wood roads, to keep the roads already built in repair, and to prevent the dust nuisance by oiling the roads.

It is sent to the subscribers so that they may know what has been accomplished and where and how their money was spent.

It is sent to the residents on the shore who have not subscribed, not only to show them what has been done to preserve its beauties and add to their pleasure, at the expense of the subscribers, but, even more, to give them an opportunity to co-operate by subscribing their fair share of the cost of the work.

Preserving the Forest.

Your committees present herewith a map showing the woodland on the North Shore which has been cleared, the brush burned, the nests creosoted and the territory sprayed during the past season. You will

EXPLANATION

TREATED WITH CREOSOTE
UNCUT
CUT IN 1910
CUT IN 1909
CUT IN 1908
COLONIES SPRAYED [S]

LAKES AND PONDS
STEAM R.R.
STREET R.R.
CARRIAGE ROADS
WOOD ROADS
BROOKS
TOWN AND CITY LINES

1910

CHARACTER OF WORK	ACRES	COST	UNIT COST
Spraying	3015 1/2	$19,651,41	$ 6.51 5/8 per acre
Tanglefooting		1,324,27	
Creosoting		6,908,33	2.17 3/4 per acre
Cutting and burning	925 5/16	20,801,31	22.48 5/8 per acre
Road building		451,31	.03 1/2 per sq. yd.

PLAN SHOWING

NORTH SHORE GYPSY MOTH COLONIES

TREATED BY STATE SUPERINTENDENT.

AUGUST - 1910

MANCHESTER COMMITTEE
MAJ HENRY L. HIGGINSON.
GARDINER M. LANE.
GEORGE WIGGLESWORTH.

BEVERLY COMMITTEE.
OLIVER AMES.
CHARLES H. TYLER.
WM. D. SOHIER.

notice that, more than ever before, the work has been circumscribed and confined to the woodland adjoining the shore and the sides of the wood roads. This was due to the fact that it was evidently an impossible task to take care of all the back woods.

The woods adjoining the shore from Magnolia to Gloucester were being rapidly destroyed, and your committee therefore took up, with the city of Gloucester and the residents in that neighborhood, the question of caring for those woods, in addition to the territory already cared for in Beverly and Manchester.

The result was that the city of Gloucester subscribed $2,500, the State agreed to contribute $2,500 and to superintend and direct the work, and the residents in that immediate neighborhood subscribed $2,535. Consequently, 305 acres in that vicinity were cared for and sprayed.

How the Work was done.

In order to give an idea of how the work was done and the plant that was necessary to accomplish it, as well as the work which was accomplished, we present herewith some half-tones that illustrate it more graphically than words can.

The first one shows the spraying machines used on the North Shore work and the auxiliary equipment, like the three gasoline pumps, the water carts that were used as tenders, the hose, etc. To do economical work it is necessary to have a gang of about eleven men with each spraying machine and about 1,000 feet of hose. In this manner a large radius is covered from the source of supply. The gasoline pumps also decreased the cost by pumping the water 1,000 feet or so.

The whole problem of economical spraying depends upon the rapidity with which the tank can be filled and emptied and the number of times this can be done during the day. Some of our new machines this year covered as much as 24 acres a day, which means that the tank was loaded and unloaded twenty-four times.

In the next two cuts we show the spray being thrown on to and in fact over the trees. Great economy was effected this year by the use of a nozzle gotten out by L. H. Worthley, superintendent, which was very easy to handle, and from which a spray could be thrown over all of the trees in the forest without climbing. This proved a great saving in time and money.

Another cut shows a cluster of gypsy moth caterpillars attempting to climb a tree which has been tanglefooted, and there are two more cuts which illustrate the value of the work which has been done upon the roadsides. These show the trees defoliated early in the season in the back woods where no spraying was done, and the trees upon the roadside which have been sprayed, their leaves being intact.

A cut is also given of Mussell Point in Gloucester, near the life-saving station, which shows graphically the importance of the work done and

what can be done. Last year there was not a single leaf left on the trees, and the ground was absolutely covered by the crawling caterpillars. This work was taken on this year in connection with the Gloucester work, the forest was cleared up, the nests creosoted and the territory sprayed, the result being that the trees were unharmed.

Another illustration of the same character would be found on the hill belonging to Mr. Cabot, directly back of the Essex County Golf Club links. This hill was thoroughly defoliated last year, the caterpillars crawling over the golf links and greens. There was very little stripping there this year, if any, in consequence of the work done.

The Work accomplished.

Roughly speaking, about 1,000 acres of woodland were cleared up and sprayed in 1908, about 2,100 acres in 1909 and something over 3,000 acres in 1910. The cost of the work is interesting, being approximately as follows: in 1908, $60,000; in 1909, $60,000; in 1910, nearly $57,000; the acreage covered in 1910 being about three times that cared for in 1908, and the total expenditure being somewhat smaller.

The work has all been done under the direction of the State forestry department, of which Mr. F. W. Rane is the head, but it has been directly in charge of his gypsy moth superintendent, Mr. L. Howard Worthley, who has under him two extremely efficient assistants in charge of the work on the ground, Messrs. Saul Phillips and Walter F. Holmes. All of these gentlemen are entitled to the greatest possible credit for their efficient work, but for which there would have been but few trees left unstripped in the Beverly and Manchester woods. In fact, there seems no doubt that the conditions would now be unbearable had the colonies been allowed to spread during the last few years.

Our Woods can be preserved.

It seems to your committee that the work which has been done absolutely demonstrates, beyond a doubt, that thorough and efficient work will preserve the woods, and this at a constantly decreasing cost per acre. You have all seen territory which was defoliated in 1909, and which is practically untouched in 1910. The conditions in the woods where work has been done are better each year, the gypsy moths are fewer, and fewer trees are being defoliated. In spite of this, the cost has been lessened.

In consequence of the efficient work on the part of the State superintendent this year, many economies have been effected, and it is hoped that much improvement may be made along this line next year. The introduction of better spraying machines is a great saving. Two new spraying machines, which were built at no greater cost than the old ones, have nearly, if not quite, double the capacity. They can spray twice as many acres in one day with the same labor force.

Spraying plant used in 1910.

How the Money was secured.

This year, as in former years, the Governor of the Commonwealth was appealed to for help. It was agreed by Governor Draper that the State gypsy moth department should take charge of the work, and that for the first money necessary, the State, the city of Beverly and the town of Manchester, and your committee, should share the expense, each paying one-third. Your committee therefore saw the officials of the city of Beverly and secured the sum of $5,000; Manchester, at a town meeting, appropriated $7,500; the State contributed $12,500; the committee contributed $12,500; making a total amount available for the work of $37,500. The balance of the expense was shared by the Commonwealth and your committees. Had it not been for the generous and hearty co-operation of the Commonwealth of Massachusetts, it would have been impossible to preserve the roads on the North Shore.

The United States Authorities co-operate.

Early in the season it was arranged with the United States authorities, through Mr. Dexter M. Rogers, who was in charge of the work in our district, that they would, from their available funds, clear out and care for the woods 100 feet wide on each side of some of the main roads, in addition to roads which they have cared for in former years, this being in line with their regular work, which is invariably in the nature of a quarantine, to prevent the caterpillars from being spread. The United States authorities therefore cleared up and creosoted the nests upon the sides of 25 miles of wood roads, or about 600 acres, spending approximately $14,500 in connection with this work. They refused, however, to take care of the woods upon the sides of the wood roads from which automobiles were excluded, on the ground that because of the exclusion of automobiles there was less danger of the gypsy moth caterpillars being carried long distances. They did, however, take care of the New Manchester Water Works Road through to Chebacco, and Hesperus Avenue in Magnolia, because automobiles were allowed to use those roads. We feel that all of our residents are indebted to the United States authorities, especially Dr. Howard and Mr. Rogers, under whose direction the work was done.

Your committee, therefore, had to take care of the roadsides on the 28 miles of wood road which are maintained by private subscription.

The same committee that served last year, Maj. Henry L. Higginson, Gardiner M. Lane and George Wigglesworth, solicited and secured subscriptions amounting to over $10,000 from the summer residents in Manchester.

Your Beverly committee secured something over $15,000 from the summer residents in Beverly, and also obtained $2,500 from the city of Gloucester, $2,500 from the State, as well as something over $2,500

which was subscribed by residents in that neighborhood. This enabled the committee to care for some of the woods near the water from Magnolia Point to Gloucester.

Cost of the Work.

According to the report of the State superintendent, the work this year was as follows: —

In Gloucester, 202 acres cleared, burned and creosoted, 305 acres sprayed, at a total cost of $7,642.82.

In Beverly, Manchester and adjoining woods, 925 acres cut, burned and many of them creosoted, 3,015 acres sprayed, etc., at a total cost of $49,137.13, not including plant and some materials.

EXPENDITURES.

Expenditures from Aug. 1, 1909, to July 16, 1910,	$43,044 63
Tools, spraying machines, etc.,	14,160 39
Bills outstanding,	937 18
	$58,142 20
Value of tools and supplies on hand,	9,005 07
Actual cost of work, not including plant,	$49,137 13

Details of Cost of Work.

Spraying,	$19,651 41	
Tanglefooting,	1,163 02	
Combing tanglefoot,	161 35	
Road building,	451 31	
Cutting and burning,	20,801 31	
Creosoting in Adams estate,	420 47	
Creosoting in Bradley estate,	49 82	
Creosoting in Walker's estate,	1,012 09	
Creosoting, general,	5,426 35	
		$49,137 13

Average Cost of Work.

Spraying, per acre,	$6 51 2/7
Creosoting, per acre,	2 17 3/4
Cutting and burning, per acre,	22 48 7/9
Road building, per square yard,	03 1/7
Cost of running one sprayer, per day,	66 16

Where the work was done on private estates, which was only in the back woods, where it came in connection with other work that your committee was doing, the money is being repaid by the owners when they are able to do so.

Spraying machines at work, showing new nozzle.

Parasites.

Many thousands of parasites have been planted in various localities in our back woods, where it was not likely that they would be interfered with by spraying, next year. Many varieties of parasites have been cultivated in this country, and so far have survived our winters, and several of them promise satisfactory results. Several of the most promising varieties have been imported in vast numbers from Japan and from Europe, and many of these have been liberated upon the North Shore. This work has been under the charge of the United States Department of Agriculture, and under the direction of its expert, Dr. L. O. Howard.

Plantings have been made, not only of the Calosoma beetle, a small green beetle, but also of several varieties of flies and smaller insects, which attack the gypsy moth in its various stages of development. Naturally, it will be several years before these parasites can develop enough to secure the balance of power, because the gypsy moths are already present in such large numbers. All the best experts agree, however, that in a few years the parasite will develop and secure the balance of power in this country, as it has already done in all other countries where the gypsy moth is prevalent. In the meantime, we must preserve all our most valuable woodland near the shore by active, efficient and co-operative work.

Dr. Howard told your secretary last winter that, while he should not feel justified officially in giving an absolute statement to that effect, he personally had very little doubt that within three or four years the parasites would develop sufficiently to obtain the balance of power over the gypsy moth caterpillars.

Another encouraging feature this year was that in some of the large colonies the wilt disease, so called, developed and attacked both brown-tail and gypsy moth caterpillars, killing them off in large numbers. One piece of woods in particular is interesting in this respect, that being the large section near Magnolia and West Gloucester, bounded by Magnolia Avenue, the State highway at Gloucester and Essex Street, which runs from the West Gloucester station toward Gloucester. Last year it was absolutely swarming with caterpillars, and there was hardly a leaf left. Your committee put three spraying machines at work there, and prevented the caterpillars from spreading by spraying some 300 feet in on the borders. This starved out a great many caterpillars, and this year the wilt disease killed many more, and consequently many of the trees in that section of woods, while they have not been sprayed, still have their leaves in fairly good condition. This is true also in other places, in the Chebacco woods and elsewhere, and is an extremely hopeful sign for the future.

Our Hopes for the Future.

Your committee believes that if the money is provided and the work continued on the lines on which it has been begun, our beautiful woods adjoining the shore can be preserved, as can also the woods immediately adjoining the wood roads.

It hopes that the subscribers and the cities and towns, as well as the United States and State governments, will co-operate in the future, as they have in the past.

It hopes that every resident or summer resident on the North Shore who has enjoyed our woods, our drives and our dustless roads, and who has not yet subscribed, or who has not yet given his fair share towards this work, will co-operate by sending a check to Wm. D. Sohier, agent, 15 Ashburton Place, Boston, Mass.

A list of the subscribers is published herewith.

WM. D. SOHIER,
For the Committee.

SUMMER RESIDENTS COMMITTEES.

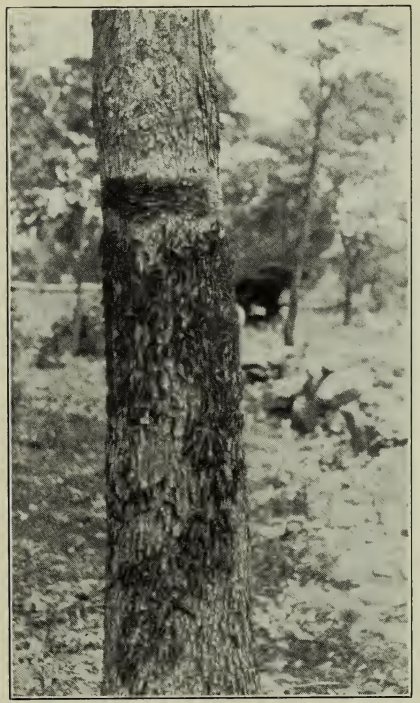
Beverly.	*Manchester.*
Oliver Ames.	Maj. Henry L. Higginson.
Charles H. Tyler.	Gardiner M. Lane.
William D. Sohier.	George Wigglesworth.

SUBSCRIPTIONS FOR GYPSY MOTH WORK ON THE NORTH SHORE, 1910.

Beverly.

Henry C. Frick,	$2,000	Robert S. Bradley,	$250
William H. Moore,	1,000	J. L. Saltonstall,	250
W. S. & J. T. Spaulding,	750	William Endicott, Jr.,	[1] 250
Oliver Ames,	500	Dr. Henry F. Sears,	[1] 250
Mrs. R. D. Evans,	[1] 500	Robert Saltonstall,	250
William Endicott,	500	Bryce J. Allan,	250
Mrs. Charles H. Dalton,	400	Frederick Ayer,	250
D. Herbert Hostetter,	300	F. L. Higginson,	250
Dudley L. Pickman,	[1] 300	Hon. William C. Loring,	250
John T. Morse, Jr.,	300	Herbert M. Sears,	250
Col. C. N. Wallace,	[1] 300	Alexander Cochrane,	250
W. B. Thomas,	250	Henry P. King,	200
Quincy A. Shaw estate,	250	Thomas P. Beal,	[1] 200
Amory A. Lawrence,	250	The Misses Loring,	200
Miss Fanny P. Mason,	250	Mr. and Mrs. Neal Rantoul,	200
George S. Mandell,	250	Cora H. Shaw,	200
William Phillips,	250	Mrs. Nicholas Longworth,	200
Charles H. Tweed,	250	Philip S. Sears,	150
Charles H. Tyler,	250	Mrs. J. B. Silsbee,	150
George Dexter,	250	F. J. and Alice Cotting,	125

[1] Available for either moth or road work.



Tanglefoot, — gypsy moth caterpillars underneath.

Wood road, — trees sprayed on roadside, stripped inside where they were not sprayed.

SUBSCRIPTIONS FOR GYPSY MOTH WORK, ETC. — *Continued.*

Beverly — Concluded.

Allen Curtis,	$100	George A. Goddard,	$100
Amos Lawrence,	100	F. I. Amory,	50
Leonard Ahl,	100	Gordon Dexter,	50
Charles Storrow,	100	T. C. Hollander,	50
Col. C. L. Pierson,	100	Dr. Franklin Dexter,	50
Mrs. Guy Norman,	100	James L. Paine,	50
A. Shuman,	100	Mrs. John S. Curtis,	50
Charles J. Morse,	100	Mrs. Franklin Haven,	50
Mrs. John C. Phillips,	100	Mrs. F. H. Peabody,	50
Mrs. James F. Curtis,	100	Mrs. Robert C. Heaton,	[1] 50
Augustus P. Loring,	100	Mrs. Hall Curtis,	50
The Misses Paine,	100	Norman F. Greeley,	25
Mrs. E. Preble Motley,	100	A. C. Ratshesky,	25
Harold J. Coolidge,	100	Charles K. Cummings,	25
Horace D. Chapin,	100		
Mrs. Samuel T. Morse,	100	Total,	$15,850
Katharine E. Silsbee,	[1] 100		

Manchester.

George R. White,	[1] $500	Mrs. S. P. Blake,	$100
Charles E. Cotting,	500	Roland C. Lincoln,	100
Lester Leland,	500	Ezra C. Fitch,	100
George N. Black,	500	S. H. Fessenden,	100
Walter D. Denegre,	300	Mrs. Edw. Wigglesworth,	100
Harrison K. Caner,	250	Mrs. Charles Hanks,	250
Gardiner M. Lane,	250	William B. Walker,	250
Henry L. Higginson,	250	Mrs. James McMillan,	250
Elizabeth Winthrop,	250	Edward S. Grew,	250
The Misses Curtis,	250	Louis Cabot,	250
Jane N. Grew,	250	Mrs. W. S. Fitz,	250
Francis M. Whitehouse,	250	Gordon Abbott,	250
F. W. Fabyan,	250	Clement S. Houghton,	250
Eben D. Jordan,	250	John L. Thorndike,	250
S. Reed Anthony,	[2] 200	George Wigglesworth,	250
Mrs. W. C. Cabot,	200	Thomas B. Gannett,	100
T. J. Coolidge, Jr.,	200	William J. Boardman,	100
Mrs. Mary R. Bremer,	200	Alex. S. Porter, Jr.,	100
R. T. Paine, 2d,	150	Amory Eliot,	100
Mrs. C. P. Hemenway,	150	T. J. Coolidge,	100
T. Dennie Boardman,	100	George Putnam,	100
Dr. R. H. Fitz,	100	George H. Lyman,	100
S. Parker Bremer,	100	William L. Putnam,	50
R. H. Dana,	100	Mrs. George D. Howe,	50
T. K. Lothrop,	100	The Misses Bartlett,	50
Samuel Carr,	100	Mrs. J. S. Sturgis,	50

[1] Available for either moth or road work.
[2] Omitted by error in 1909.

SUBSCRIPTIONS FOR GYPSY MOTH WORK, ETC. — *Concluded.*

Manchester — Concluded.

Richard Stone,	$50	Russell Tyson,	$25
Miss E. D. Boardman,	50	John H. Storer,	10
William A. Tucker,	50	Arthur Merriam,	10
Henrietta M. Crosby,	50		
Samuel B. Dana,	50	Total,	$10,470
Nelson S. Bartlett,	25		

Totals.

Beverly,	$15,850
Manchester,	10,470
Total,	$26,320

Magnolia.

John Hays Hammond,	$500	C. D. Turnbull,	$100
Miss E. G. Houghton,	250	Mrs. Mary Turnbull,	100
John T. Morse, Jr.,	200	George A. Upton,	75
Charles E. Phenix,	200	James S. Lee,	50
Miss Faulkner,	200	Mrs. J. T. Heard,	50
William H. Coolidge,	100	Miss Georgina Lowell,	50
E. C. Richardson,	100	R. B. Williams,	25
Mrs. L. F. Ayres,	100	Anonymous,	25
W. R. Nelson,	100	Mrs. S. W. Covel,	10
Mrs. William McMillan,	100		
George F. Willett,	100	Total,	$2,535
J. Harrington Walker,	100		

GYPSY MOTHS SPREAD BY THE WIND.

It is a well-known fact that caterpillars of the gypsy moth are distributed from badly infested colonies on automobiles and teams, and proof is at hand that they have sometimes been carried by farm animals.

During the progress of the gypsy moth work, especially the scouting operations in the territory outside of the badly infested district, many colonies of the insect have been found in locations remote from roadways, and often in wooded areas seldom frequented by men or domestic animals. The repeated occurrence of colonies in such situations rendered it very difficult to explain in a rational way the means by which the insect became established. It has often been suggested that birds might be considered responsible, as some species are known to carry hairy caterpillars to their nesting places for the purpose of feeding their young. The present scarcity in eastern Massa-

Mussell Point, Gloucester, entirely defoliated in 1909; in 1910 cleared, treated and sprayed, — trees in good condition.

chusetts of birds which are known to feed to any great extent on hairy caterpillars, together with the distance from badly infested areas to new colonies, which was often several miles, renders it improbable that the distribution can be accounted for in this manner. The question also arose in regard to the possibility of birds feeding upon the egg masses of the gypsy moth, and distributing fertile eggs in the excrement at points far removed from where the food was obtained.[1] The location of many of these colonies made this theory improbable, and certain tests which have been made on birds in confinement seem to indicate that it is very unusual for eggs to pass unharmed through the alimentary tract. It is somewhat doubtful whether eggs of this insect are eaten by birds, under natural conditions. Furthermore, the digestive process of birds is carried on very rapidly, and it is improbable that under the most favorable conditions eggs could be conveyed long distances.

As a result of the continual discussion of the reason why certain isolated colonies had come into existence, and of much thought and consideration upon this subject by practically all the officials connected with the gypsy moth work, it was decided to carry on a series of experiments, for the purpose of determining, if possible, whether newly hatched caterpillars of the gypsy moth could be distributed by the wind. Accordingly, early in the spring of 1910 arrangements were made for these tests to be carried on in a co-operative way by the United States Bureau of Entomology and the office of the Massachusetts State Forester. The work was under the general charge of Mr. A. F. Burgess, who was assisted by Mr. C. W. Collins, both of the Bureau. The necessary apparatus and supplies were furnished by the State Forester's office, and also several men who assisted in the work at various times. Among those who should be specially mentioned were Messrs. J. V. Schaffner, Emery Proctor and H. R. Gooch. In planning the experiments, much assistance and valuable advice was given by Messrs. W. F. Fiske and D. M. Rogers of the Bureau, also by Messrs. L. H. Worthley and F. H. Mosher.

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[1] Collins, "Some Results from feeding Eggs of *Porthetria dispar* to Birds," Journal of Economic Entomology, Vol. 3, No. 4, August, 1910, page 343.

Reiff, "Some Experiments on the Resistance of Gypsy Moth Eggs to the Digestive Fluids of Birds," Psyche, Vol. XVII., No. 4, August, 1910, page 161.

Experiments were made in several localities where conditions were suitable for a thorough test. In order to capture caterpillars that might be floating in the air, screens made of ordinary poultry wire were constructed, and treated with a coating of tanglefoot. Two screens of this sort were built on rafts, one of which was moored in the center of Sandy Pond in Lincoln, and the other in Chebacco Lake in Essex. The woodland surrounding these bodies of water was badly infested with the gypsy moth. Another screen was placed on the top of a high tower in the Lynn woods, while still another was exposed on the sides of a tower at Cliftondale.

The results of these experiments were not entirely satisfactory, although a few caterpillars were found on the screen trap on Sandy Pond.

Another test was made by liberating young caterpillars from a station near the center of the salt marshes between Revere and Lynn. These marshes cover a large area, and the experiments were well isolated from any trees or shrubs upon which gypsy moth egg clusters might be found. Small, portable, tanglefooted screens were set up at various distances from the station where boxes containing hatched egg clusters were placed in such a manner that the caterpillars were allowed to crawl out and spin down from one side of the containers. The screens had to be changed frequently, as it was necessary to keep them in line with the direction of the wind. Caterpillars were caught on these screens at distances varying from 50 to 600 feet; and upon one screen which was allowed to remain out during the night of May 11, and which was 1,833 feet from the point of liberation, a single caterpillar was found the following morning.

These experiments demonstrated conclusively that small caterpillars of the gypsy moth may be carried by wind. This method of distribution is probably most frequent when the caterpillars are in the first, or possibly in the second, stage, at which time they spin large quantities of silk for the purpose of lowering themselves from the trees or foliage. It is probable that these insects are often carried long distances in this way, and that large numbers of them perish every year because they fail to come in contact with suitable food.

The result of this investigation shows the grave danger of

permitting large woodland colonies of the gypsy moth to exist, because, when the infestation becomes severe in any area, the opportunity for wide dissemination of the insect increases very rapidly. A study of the gypsy-moth-infested area in New England shows very plainly that localities many miles removed from badly infested areas must have become infested in this manner between the years 1900 and 1905, during the time when no work was done to prevent the spread of this insect. The results also explain the reason why small colonies are being found each year in the outlying towns.

Spraying not a Destroyer of Birds.

There has been a general feeling abroad that spraying with arsenate of lead has been and is destroying our birds. In order to determine this matter, we have had many birds sent to the chemist and tested for arsenical or lead poisoning. The results of these examinations have all been in the negative. Similar although more extensive work has been carried on by the State Ornithologist, Mr. E. H. Forbush, the results of which have been published in his annual report for the year 1909, which can be had from the Massachusetts State Board of Agriculture, State House, Boston, upon application. Mr. Forbush examined many birds, first for injury, and second, for poisoning. The following quotation from his report gives a comprehensive statement of conditions: —

Investigations of the possible poisoning of birds by spraying trees with arsenical insecticides were continued through the summer of 1909. The result was inconclusive, but from what we now know it seems probable that the fatal effects of such spraying have been exaggerated both by the people and the press. We cannot say that no birds die from eating live, poisoned insects, from eating poisoned foliage or from drinking poisoned water; but after several years' study of the subject it seems safe to assume that although probably some birds are fatally poisoned, they are the exception and not the rule. Probably there is far more destruction of birds where unsprayed trees are stripped of their foliage by the gypsy moth and the brown-tail moth than where spraying is done and the foliage is saved. The defoliation of the trees by these insects, which exposes the nests of the birds to the sun and rain and to their natural enemies, results in the death of nearly all young birds in a region so defoliated, while the spraying probably

kills at most comparatively few. The dearth of birds in parts of the region infested by the gypsy moth and the brown-tail moth is no doubt due largely to defoliation, as well as to the filling of holes in trees where birds formerly nested, and the cutting down of trees as well as the cutting and burning of underbrush. These operations, which are necessarily a part of the work of the moth suppression, are not destructive to birds if not carried on in the nesting season, but they drive them away. The effect of the spraying operations upon birds may be illustrated by the case of the rose-breasted grosbeak. This bird is very fond of the Colorado potato beetle. Potatoes have been sprayed with Paris green and other arsenical insecticides ever since this beetle first appeared in New England, and there is much circumstantial evidence which seems to point to the death of rose-breasted grosbeaks which have fed among the poisoned potatoes. Nevertheless, the Colorado beetle has furnished a new food supply for the grosbeaks, and the birds appear to be more numerous in Massachusetts than they were forty-five years ago, before the beetle was introduced.

The results of the investigation of the year follow. Letters were sent early in May to many correspondents, and notices were published widely in the press requesting all persons finding dead birds near sprayed trees to send them to the State Ornithologist for examination. Much correspondence resulted and many dead birds were received at this office. Some correspondents were positive that large numbers of birds had been killed by the spraying in their neighborhoods, but most of them failed to produce any dead birds. Many correspondents in Massachusetts and other States, tree wardens, nurserymen, orchardists and others who made a business of spraying trees, and who claimed to have kept a careful watch for dead birds, reported that they had failed to find any. People on whose estates spraying had been done wrote that they had instructed their men to keep a close lookout for dead birds, but that none had been found.

Parasite Work.

Report of Dr. L. O. Howard, Chief of the Bureau of Entomology, Washington, D. C.

United States Department of Agriculture,
Bureau of Entomology, Washington, D. C., Nov. 30, 1910.

Prof. F. W. Rane, *State Forester, 6 Beacon Street, Boston, Mass.*

Sir: — I have the honor to report as follows upon the work done by this Bureau in its co-operation work with your State in the attempt to import and establish in New England the foreign parasites of the gypsy moth and the brown-tail moth, this report covering the period since the submittal of my last report, on Dec. 29, 1909.

Respectfully yours, L. O. Howard, *Chief of Bureau.*

The work of the gypsy moth parasite laboratory continued uninterruptedly during the year, consisting of: —

(*a*) Importation of parasites and predatory enemies from abroad.

(*b*) Rearing these parasites and predators in the laboratory, and wherever possible breeding them in numbers from imported parent stock.

(*c*) Colonization in the field of the parasites thus obtained.

(*d*) Field work to determine their progress in America.

(*e*) Investigations into their biological and general relations.

(*f*) Field and laboratory investigations into the parasites of native insects most nearly related to the imported pests either in habit or in natural affinity, with especial reference to the probable effect which the introduction of the foreign parasites will have upon the economy of the native parasites and of their hosts.

Larger quantities of the raw material from which the parasites have been reared have been received than during any other year. This has consisted, as heretofore, of eggs, winter nests, caterpillars and pupæ of the brown-tail moth from Europe; and of eggs, caterpillars and pupæ of the gypsy moth from Europe and Japan; large numbers of adult predatory beetles and thousands of parasite cocoons and puparia. But for numerous reasons, although the amount received was larger, the results obtained, owing partly to the condition of the material on receipt and owing to curious seasonal fluctuations and differences in the countries of origin and in the infested territory in America, the results have by no means corresponded with the increased material.

During the year 1909 two important parasites of the gypsy moth (*Blepharipa* and *Parasetigena*) were imported in large numbers. They were both hibernated successfully, and colonized under ideal conditions in the spring of 1910.

During 1910 determined efforts have been made to secure adequate numbers of several interesting and probably valuable parasites not yet secured in quantities sufficient to provide for satisfactory colonies; but for the most part these attempts seem to have resulted in failure, although final word cannot be said at this time.

As the work goes on, there seem to be almost as many disappointments as successes. For example, no less than one million of the Japanese parasites of the eggs of the gypsy moth were reared during the summer of 1909 and the winter and spring following, and great hopes were entertained for its success, but from the present point of view it appears to be wholly unable to withstand the rigors of the New England winter; and another egg parasite, a European species, of which several hundred thousands were reared in confinement, does not appear to make an impression upon the numbers of the gypsy moth eggs in America.

On the other hand, success of the most promising character has been

reached with others of the imported species. *Calosoma sycophanta,* an imported European predatory beetle, was the first of the imported species to be recovered from the field under circumstances indicative of its ability to exist under American conditions. The season of 1910 is the fourth during which its progress has been conscientiously followed, and during each of these seasons it appears to have combined a steady rate of increase of approximately tenfold, with a rate of dispersion in excess of one mile a year in every direction from the center of the original colony. A tenfold rate of increase annually means that one hundred beetles liberated in 1906 would have increased to one million by 1910, and the actual prevalence of the beetle in the field is such as to make this appear a reasonable estimate of the numbers actually existent. They were so abundant in some localities the past year as to affect the gypsy moth materially, although by no means so materially as to meet and overcome the strong reproductive ability of the pest. If, as there is reason to hope, they will continue to increase at this slow but steady rate for some years to come, their effect upon the present prevailing abundance of the moth will be apparent to all.

Another encouraging example is the Tachinid fly of the genus *Compsilura,* which attacks both the gypsy and the brown-tail caterpillars as an internal parasite. This species was first liberated in 1906, and was first recovered in 1909 under circumstances indicative of its establishment in America. During 1909 it was found distributed over about five towns adjacent to the one in which the first imported colony was liberated. It was everywhere rare during that year. In 1910 it was expected that it would show a marked increase, but the actual outcome was in excess of all expectations. Instead of a tenfold increase, which would have been considered satisfactory, there seems good evidence that it increased fiftyfold and perhaps much more. It has about equaled *Calosoma* in actual destruction of gypsy moths this year, and in addition has destroyed an appreciable percentage of the brown-tail caterpillars; and it is now turning its attention to such native species as the fall webworm, the tussock moth and other fall-feeding caterpillars. Its increase has been accompanied by a dispersion amounting to ten or twelve miles in every direction as a minimum aggregate during the four years since its first colonization.

Still another example is the European *Monodontomerus,* the recovery of which over a large area was made the subject of especial mention in the last report. This species has continued its satisfactory rate of increase and phenomenal rate of dispersion throughout the year. It is well over the border line in New Hampshire, and appears to be extending its range about ten miles each year, and to be maintaining a twenty-fivefold annual increase.

It has been somewhat disheartening, in the course of the study of the progress of the parasites in the field, to find that certain species liberated under the most favorable conditions cannot be recovered the

next year; and even in the case of two species, both colonized in 1908 and apparently established in 1909, no traces could be recovered in 1910. But, on the other hand, another species (*Zygobothria*), colonized in 1907, was recovered in 1910, three years later, for the first time, — in small numbers, it is true, but over a considerable territory, indicating a rapidity of dispersion sufficient to render a material increase unnoticeable for the first two years.

Another encouraging fact which may be mentioned here is that an important egg parasite (*Anastatus bifasciatus*) seemed this summer to have demonstrated its ability to survive the New England winter, and, having been colonized in 1909, appears to be strongly established in 1910.

On the whole, the results of the work are distinctly more encouraging than they have appeared to be heretofore, and we are by no means disheartened over the non-recovery during the present season of no less than fifteen species which have been colonized. In several instances colonization has been much too recent to make their recovery probable, on account of rapid dispersion; and several others have never been received in sufficient numbers to make a strong colony possible, so that it may well be that establishment has not yet been accomplished. It has been found in the course of this work that there is little hope of the establishment of a colony of less than one thousand individuals, and in many instances of course it has been found impossible to put out so large a number.

The insight which is being gained at the laboratory into many points connected with the biology of these important and interesting insects is resulting in practical knowledge that cannot fail to be of high importance in the continuation of the investigation.

The writer visited Europe in May and June, 1910; visited agents and officials in Italy and France; and, through the courtesy of the Spanish and Portuguese governments, was able to start a new official service in each of these countries for the collection and sending of parasitized gypsy moth larvæ to the United States. In Italy Prof. F. Silvestri of the Royal Agricultural College at Portici, and Dr. Antonio Berlese, Director of the Royal Agricultural Entomological Station at Florence, insisted on the desire to be of service to the United States in this direction, and declined all financial aid. In Spain, Prof. L. Navarro of the Phytopathological Station at Madrid volunteered his services under the same conditions, with the approval of the Minister of Agriculture. In Portugal, Prof. A. F. de Seabra of the Phytopathological Station at Lisbon also volunteered his services, with the permission of Senor Alfredo Carlos Le Cocq, Director of Agriculture. In France, arrangements were made with a paid agent stationed in the south of France; and the same arrangements as in previous years were made with paid agents in Germany and Switzerland. The distributing agency at Hamburg was continued, and a new distributing agency was

started at Havre, on account of its convenient proximity to the American steamers starting from Southampton.

Sendings from Japan were continued in the same manner as during the previous year. The Minister of Agriculture for Japan, at the request of the Secretary of Agriculture of the United States, again designated Prof. S. I. Kuwana of the Imperial Agricultural Experiment Station at Tokio to be its official representative in the work to be carried on during the spring and summer of 1910. Professor Kuwana continued his most valuable sendings.

The thanks of the United States government and of the governments of the States involved are due in high measure to the officials of Italy, Russia, France, Spain, Portugal and Japan, who have assisted in this work. All of them have been named at one time or another in this series of reports.

In the autumn of 1910 Mr. Fiske visited Russia and France for the purpose of studying autumnal conditions of the parasites in their native homes, and in order to obtain information on certain points needed for future work. It seems that the time has arrived to reduce the large bulk of the importations, and in the future to bring over only those species which have not yet been received in sufficient abundance to establish perfect colonies. Mr. Fiske's mission was to study the best methods of bringing this about and to learn something about the probable methods of hibernation of some of the species concerned.

The Fungous Diseases of the Brown-tail and the Gypsy Moths.

The State Forester was able to make arrangements with Dean W. C. Sabine and Dr. Roland Thaxter of Harvard University for continuing the co-operative work on fungous diseases, and Mr. A. T. Speare, who has been assisting Dr. Thaxter, was taken over by the State Forester's department. He has devoted his entire time to this work throughout the past season. The following report has been prepared by Mr. Speare: —

The writer having been authorized by the State Forester to continue during the year 1910 the work undertaken in 1909, for the purpose of testing the practical value of artificial infection with fungous diseases of the brown-tail and gypsy moths in the field, desires to present the following preliminary report. Owing to certain experiments which have not been completed, it is not possible at this time to present a full statement. The writer hopes, however, to be able to present early next spring a complete illustrated report of the work that has been done with the parasitic fungi of the brown-tail and gypsy moths. The work

in question is a phase of a project undertaken with the co-operation of Harvard University for the purpose of studying and testing the various diseases of the brown-tail and gypsy moths.

This report comprises, in addition to an account of experiments with the brown-tail *Entomophthora,* a preliminary statement in regard to the successful importation of a corresponding disease of the gypsy moth larvæ by Dr. Clinton, who was sent to Japan for this purpose under the direction of Harvard University in May, 1909.

In order to render the matters of this report intelligible to persons unacquainted with the subject, it seems desirable to give a brief summary of the life history of the *Entomophthora* disease of the brown-tail, with results of the year's work, and a brief account of the first year's experiments with the gypsy moth disease.

The cause of the brown-tail disease is a microscopic plant. The symptoms of this disease are quite peculiar. The caterpillar exhibits no special peculiarities immediately after infection, but at the end of the fourth or fifth day its movements become sluggish; it attempts to eat no more, but seeks some elevated spot. It seems seized with some impulse to get up high. It accordingly crawls upward, becomes attached by certain of its legs, and shortly afterward dies.

The body before this period appears normal externally. Soon after the caterpillar has become fastened to the bark, however, the body becomes rigid. Caterpillars can be found most abundant at this stage from 3 to 5 o'clock in the afternoon. If the body is broken (it can easily be broken), the entire internal tissue of the caterpillar will be seen to have been replaced by creamy-white flocculent or granular matter; this is the vegetative part of the plant. During the night following, if the weather conditions be favorable (a certain amount of moisture), the fungus will further develop by sending spore-bearing organs to the outside of the body. When examined, the next day, the external appearance of the caterpillar will be seen to have changed entirely. Now, instead of the body presenting a normal appearance, the creamy-white matter is seen on the outside. This creamy-white matter is composed of organs which are part of the plant inside, but especially differentiated to produce spores. By a process which we will not detail, the spores are formed, and as the plant absorbes water the spores are literally "shot" into the air to a distance often of three-quarters to one inch from the caterpillar. The result is (if the caterpillar is attached to the branch) the formation of a creamy-white halo on the bark, which is composed entirely of fungous spores, and by which the disease can easily be recognized.

It must be understood, however, that the spores thus seen on the bark do not represent the total discharge, but only a small portion of it. The majority of the spores discharged from the dorsal as well as the lateral sides float off in the air. One can now see the advantage of having the caterpillar in an elevated position when the spore dis-

charge occurs, inasmuch as the higher the larva is, the greater the amount of territory the spores will cover when they are discharged. Spore dissemination is also augmented by winds. These spores when they are discharged into the air float about, and a certain per cent. of them will adhere to healthy caterpillars, on which they will germinate and produce the disease with the symptoms described above.

With the brown-tail the period of incubation (that is, the time from infection to the production of new spores) is from four to six days, varying with the size of the infected individual, the temperature and weather conditions. A well-grown caterpillar under favorable conditions would probably discharge several hundred thousand spores, each capable of infecting a fresh larva in case it comes in contact with one; and among gregarious insects, such as the ones in question, the chance of copious infection is great.

During the past year the field work has been undertaken on a much larger scale than heretofore, and a new method of planting was employed. This spring, instead of planting in isolated places, as has been the custom, a solid block of territory was chosen, comprehending about 10 square miles, and the plantings were all made in this area. Without going into details as to methods of infection, etc., it is enough to state that at the end of the season a mortality of 92 per cent. was estimated throughout this whole area. In parts of this territory not a single live pupa could be found.

This last autumn the writer, not being able personally to plant all of the territory that was deemed desirable, was aided by eight of the division superintendents of the regular moth commission, and with their help 60 isolated plantings were made. Reports that have been received seem to guarantee an average mortality of 38 per cent. in 48 of these 60 plantings. As we believe that the fungus will develop further in these plantings next spring, it seems desirable to wait until after the spring season before estimating the total mortality.

The gypsy *Entomophthora* was successfully carried over winter by means of resting spores, but for reasons which we will not detail the conidial condition (the stage in which the fungus is planted in the field) was not obtained until June 2. The life history of this fungus is very similar to the life history of the brown-tail, and need not be described here. A sufficient amount of infected material could not be obtained for planting until about the middle of June, at which time the gypsy larvæ were quite large. However, 6 plantings were made in isolated places before the close of the season. Although the territories were carefully inspected as often as time permitted, the writer was unable to detect any evidence of the fungus. Owing to the exceptionally hot and dry months of July and August, the fungus may have formed resting spores, in which condition it could have been easily overlooked, as externally this condition resembles in a striking manner the advanced stages of the "wilt." It is of course possible

that this may be the case and that the resting spores may germinate and start infections in the field next spring.

The results of this season's work, however, must not be considered as final in regard to the use of the gypsy *Entomophthora* as a means of destroying the gypsy larvæ. In the first place, the writer was handicapped by starting late; in the second place, the season was very hot and dry (conditions unfavorable for the development of the disease); in the third place, at the time the fungus was introduced the "wilt" was well established in all of the places that were planted with the fungus.

The writer hopes to get the fungus started much earlier this spring, and, with more favorable weather conditions during the summer, hopes at some later date to be able to report more satisfactory results than the above.

The Disease of the Gypsy Moth.

The various lines of work reported on as begun last year under Dr. Theobald Smith of the Harvard Medical School, Prof. W. M. Wheeler of the Bussey Institute of Harvard University and Dr. E. L. Mark of the Harvard Zoölogical Laboratory, were again pursued during the past season.

The work of Dr. Smith, through his assistant, Dr. H. N. Jones, is given below. The work carried out under the supervision of Dr. Wheeler, by Mr. Reiff, will be reported on later. The work carried out by Mr. J. W. Mavor, under the direction of Dr. Mark, has been completed for the present.

Further Studies on the Nature of the Wilt Disease of the Gypsy Moth Larvæ.[1]

The season of 1910 afforded an exceptional opportunity for the observation of this most interesting epizoötic. Because of the wide distribution and high virulence of the disease in 1909, its prospective appearance in 1910 was awaited with much interest.

Observation of the field conditions the past summer seems to have answered fairly conclusively two important questions regarding the epidemiology of the disease, — questions which suggested themselves before the advent of the season. Would the surviving gypsy moths of the previous year have transmitted to their offspring the immunity for the disease which they themselves seemed to possess? In other words, would the disease limit itself by the nearly complete elimination of susceptible individuals, and after a season of great activity be forced to wait through a number of seasons until a generation with low im-

[1] By Henry N. Jones, Laboratory of Comparative Pathology, Harvard Medical School.

munity should appear? In reply to the above questions, it can be pointed out that, in spite of the heavy mortality from the disease in 1909, most field observers agree that it was much more severe in the past summer. This fact is reassuring, as it relieves the fear that in the conflict with the pest of the gypsy moth we may be deprived of the assistance of this disease. Other conditions, at present unknown, may of course operate in the future for the suppression of this disease; but there seems to be no ground for believing that the general immunity of the gypsy moth will increase to such a degree as may curtail the inroads of the disease.

The second question which suggested itself was this: Would a summer which presented marked variation in climatic conditions from the usual seasonal average appreciably affect the disease or its epidemiology? That is, would an unusual amount of hot weather, or cold weather, or a very dry season, or a very wet summer, affect the disease? Fortunately for the solution of this question, the past summer was unusually dry and warm, with a great amount of sunshine. Apparently the disease is at least in no wise checked by such meteorologic conditions. Should a season appear which presents the reverse of these conditions, it will be very interesting to observe the effect, if any, upon this disease.

The amount of sunshine to which a gypsy moth larva is exposed during its development to maturity depends somewhat upon the environment, and there may be still other factors than sunshine dependent on the environment, such as character of the food supply. Whatever may be the primary cause, it seems evident that larvæ inhabiting a territory where the growth of trees is uniformly very young do not suffer from the disease so early in life nor in such great numbers as do those living on trees of more mature growth.

Observation of the disease in the field, however, although it has revealed several facts which are interesting of themselves, seems to have failed to reveal anything of a broad and fundamental character which might throw some light on the real nature of this disease and the laws governing its transmission.

In the study of this disease in the laboratory the methods used the past summer differed somewhat from those of the previous year, as will appear from the procedures outlined below. The hope was entertained that the study of sectioned material might reveal some very important facts about the pathology of the wilt disease, but this hope was not fulfilled. While it seems that the histological study of normal and diseased caterpillars ought to do much toward the solution of the problem of this disease, yet very many difficulties which seem almost insurmountable are met in the attempt at such a study. The degeneration of the tissues of the animal in this disease is so remarkably rapid and complete, and the chitinous integument is so tough, that the difficulty of cutting good sections can be readily seen. Sections of diseased

animals usually show nothing but the skin, intestinal tract, tracheal system, and, if the histolysis has not progressed too far, fragments of the musculature. It seemed evident that the process of tissue digestion, which seems to constitute the most remarkable feature of the disease, first attacks the fat bodies and later the muscles, while the chitinous structures naturally survive intact for an indefinite time. Probably it may be more accurate to say that the tissues are able to resist the action of the enzyme, or whatever it may be, in the order named, rather than that the disease attacks them in that order. It is also interesting to note that the digestive tract not only remains intact, but that often undigested food is found in the intestine of animals whose tissues have undergone complete dissolution. No trace of anything that could be considered a parasite could be found.

In the bacteriological study of the disease, the dead and living larvæ were opened aseptically and cultures then made both from the blood and from the intestinal contents. Many of the tubes of broth thus inoculated even from the dead larvæ remained entirely sterile, and several times the only growth obtained was the common white mold. The different species of bacteria isolated behaved as a non-pathogenic intestinal flora. Organisms which possessed the power of liquefying gelatine were only occasionally met with. The only organism isolated with any fair degree of constancy from the caterpillars was the small, motile, diplo-bacillus described in the report of the work for 1909.

The microscopical examination of the larvæ while fresh rarely showed bacteria to be present in more than small numbers. Indeed, the body fluids of the dead larvæ seemed to be quite remarkable for their rather singular freedom from bacterial life, presenting as they did a marked contrast to the usual abundant flora of body fluids exposed to invasion by saprophytic bacteria. The caterpillar's relative freedom from bacteria, as contrasted with the condition of the higher animals, is doubtless to be explained, in part at least, by two conditions. The food of the gypsy moth larvæ is evidently singularly free from bacteria, and few of those bacteria introduced into the intestinal tract find conditions favorable for their multiplication; hence the intestinal tract of the caterpillars is exceptionally free from bacterial life, and the tough chitinous outer integument effectively prevents the post-mortem invasion of bacteria through the surface.

In order to compare the changes occurring in the bodies of larvæ killed by various agencies with the changes occurring in larvæ dying by disease, many larvæ were killed. The attempt was first made to kill the caterpillars by severe trauma, viz., crushing the head with a nip of the forceps. Strange as it may seem, however, to those accustomed to observing only the higher animals, it was found that, owing to the absence of a complex nervous system in the caterpillar, it was altogether impracticable to kill the animals by any injury which stopped much short of their total disintegration. The caterpillar of

the gypsy moth possesses such extraordinary tenacity of life that it is not noticeably affected by the complete crushing of its head, living on in this mangled condition indefinitely until starvation occurs. It is also very resistant to the vapors of alcohol and chloroform, so that it cannot be satisfactorily killed by such means.

It was found that the post-mortem appearance of the larvæ killed by drowning never at any time resembled that of those that had died of the disease. At no time did the bodies of the drowned become flaccid, nor were the body contents transformed into a fluid condition.

Attempts were made in several ways to transmit the disease to apparently normal larvæ, but the results were not satisfactory. Such a large percentage of animals among the controls die under what are considered the best of conditions, that the greatest care is necessary in interpreting the results of infection experiments.

Cultures of various bacteria isolated from dead larvæ were injected into the hæmocoele of normal animals. These bacteria could be found in the blood, in enormous numbers, for a considerable time after inoculation, sometimes as long as seventy to eighty hours. They were never recovered after the third day, if the animal survived, and were much less numerous on the second day than on the first. Several pupæ were also inoculated with a small quantity of a pure culture of bacillus A. These animals harbored the bacteria in quantities for fourteen days, and died without maturing.

The presence of the so-called "polyhedral bodies," which several observers have considered of significance, was constant in the fluids of the diseased caterpillars. These bodies are presumably similar to those described by Bolle, and thought by him to be protozoa (*Microsporidium polyhedricum*), and concerned in the production of a disease in silk worms which seems to be quite similar clinically to the disease of our gypsy moth larvæ. Several other investigators have noted the presence of these bodies in diseased conditions of the silk worm, and some have agreed with Bolle in considering them to be protozoa; while others, particularly Sasaki of Tokio, are unable to satisfy themselves that they are more than some degeneration product of the body tissues. The opportunity was afforded for examining the tissues of young silk worms obtained through Dr. Bolle, and said to be infected with *Microsporidium polyhedricum*. Large numbers of polyhedral bodies were to be found apparently not differing from those to be found in the fluids of caterpillars dying of the so-called wilt disease in this country. Nothing could be observed, either in the structure or reactions of these bodies, as found in the gypsy moth larvæ, which could possibly be interpreted as indicating that they were living organisms. The observations of Sasaki as to the reactions to chemicals and appearance of these bodies were confirmed. The splitting of these bodies into sectors which Sasaki mentions as occurring when the bodies are subjected

to pressure, was frequently noticed when the bodies had been subjected to no known pressure. This action seemed to be due entirely to internal stresses acting on the bodies.

In addition to these polyhedral bodies, which were always found in enormous numbers in the fluids of the sick and dead larvæ, there were frequently to be found in the blood of normally appearing caterpillars certain bodies of a very different appearance. These consisted of a variable number (12 to 18 or more) of hyaline bodies, 4 to 5 microns in diameter, nearly round, which were bound in a compact mass by a thin, external envelope. These masses were sometimes so numerous in the blood that several could usually be found in a single field of the 2 mm. immersion lens. These are apparently cells of the body which, during certain changes of the body metabolism preceding molting, and probably at the onset of the disease, are freed in abnormal numbers into the circulatory system. They are apparently similar to the "cellules amiboides granuleuses" which Janet describes in a paper on the anatomy of the thorax of the ant, although amœboid motion was never observed. The examination of the blood of a considerable number of apparently normal caterpillars would always reveal some in whom the blood presented an opaque, clouded appearance, much like bouillon with a bacterial growth. The microscopical examination of such bloods always showed the presence of considerable numbers of these cells and greater or smaller numbers of the polyhedral bodies. It was observed that this condition of the blood portended one of two things: either the animal so afflicted molted, or died of the "wilt."

All that can be said regarding the nature of the cause of this disease at present is that, while many interesting hypotheses may suggest themselves, such as the possibility of its being a curious miscarriage of the function of molting, what few data of any value have been obtained are entirely of a negative character; and that we must await the results of much further investigation for the final solution of this most interesting and important problem.

Papers to which reference has been made: (*a*) Johann Bolle, Der Seidenbau in Japan (die Gelb oder Fettsucht der Seidenraupe, — eine parasitäre Krankheit). (*b*) Professor Sasaki, On the Pathology of the Jaundice of the Silk-worm (Journal of the College of Agriculture). (*c*) Charles Janet, Anatomie du Corselet et histolyse des Muscles vibrateurs, après le vol nuptial, chez la reine de la Fourmi.

Bulletin on Parasites.

There seemed to be a desire on the part of many of our people to know more in detail than has been given them in the past about the parasitic work which the State has been carrying on since 1905; and it was to give this information that the

United States Entomologist, Dr. L. O. Howard, who has been our chief adviser in this work, was prevailed upon to have a bulletin prepared. This bulletin, entitled "Parasites of the Gypsy and Brown-tail Moths introduced into Massachusetts," was published by the State Forester and distributed generally. The bulletin was written by Mr. W. F. Fiske, expert in charge of the State laboratory at Melrose Highlands. This bulletin, which gives a comprehensive idea of the work being undertaken by the State, has been well received. It can be had by any one interested, by applying to the State Forester.

Post Cards in Colors.

During the past season the State Forester had printed fifteen thousand each of three different post cards, illustrating in natural colors and size the various transformations in the life histories of the gypsy moth, the brown-tail moth and the *Calosoma sycophanta* beetle.

Although the above-named moths have both been extremely destructive in eastern Massachusetts, it has not been uncommon to find that our people are continually mistaking one for the other. During last year even some of our newspaper reporters made this common mistake.

These illustrated cards have served to clearly set forth the characteristics of each moth. Besides giving their natural size and color, the cards contained a brief description of each insect, together with a statement of the most economical method of treatment. In the case of the *Calosoma* beetle the object of printing the card was to familiarize every one with the insect, so as to give it protection. It is an insect imported for the purpose of assisting in destroying the gypsy and brown-tail moths.

These three post cards have been greatly sought after by our people, and served very nicely for educating our young in the schools.

They can be had by our Massachusetts people by applying to the State Forester, 6 Beacon Street, Boston.

This hand cart is economically used in the moth work, as all necessary tools for supplying a working crew can be easily transported, and the customary expense of horse hire saved.

Financial Statements.

In our financial statement, given below, we show a balance of $19,992.47. This balance will be disbursed during the coming month in reimbursements to towns and cities which have not yet returned final papers of the year's expenditure to this office.

General Appropriation.

Balance from 1909,	$4,143 05	
Appropriation for 1910,	150,000 00	
Appropriation of March 18, 1910,	150,000 00	
Cash returned by Merrimac Chemical Company,	850 68	
Cash transferred from special North Shore fund for tools and supplies furnished,	13,870 81	
		$318,864 54
Office expenses: —		
Salaries of clerks,	$2,391 50	
Rent,	2,454 17	
Stationery and postage,	1,347 25	
Printing,	835 42	
Experts,	100 00	
Furniture, etc.,	32 75	
Sundries,	1,004 65	
Educational work,	14 77	
Field expenses: —		
Wages of employees,	24,951 39	
Travelling expenses,	9,106 63	
Supplies,	86,740 98	
Special work,	22,500 00	
Supplies for experiment,	1,231 58	
Sundries,	895 77	
Reimbursement,	145,265 21	
		298,872 07
Balance on hand Nov. 30, 1910,		$19,992 47

Parasite Appropriation.

Balance from 1909,	$11,530 46	
Appropriation of March 18, 1910,	15,000 00	
Cash returned by American Express Company,	7 70	
		$26,538 16

Expenditures: —		
Wages of employees,	$11,193 10	
Travelling expenses,	1,868 12	
Rent,	380 00	
Supplies,	1,232 34	
Stationery and postage,	166 51	
Printing,	1,332 40	
Experts,	162 00	
Sundries,	846 07	
Supplies for experiment,	23 80	
Importation of parasites,	5,654 47	
		$22,858 81
Balance on hand Nov. 30, 1910,		$3,679 35

Special North Shore Fund.

Balance from 1909,	$773 05	
Deposit by F. W. Rane, State Forester,	22,500 00	
Deposit by Wm. D. Sohier, agent,	22,500 00	
Deposit by city of Gloucester,	2,500 00	
Deposit by city of Beverly,	5,000 00	
Deposit by town of Manchester,	7,500 00	
Cash returned for error on pay roll,	12 00	
Cash received for work on private estates,	4,409 50	
Cash returned to fund for accounts undrawn,	27 06	
		$65,221 61
Expenditures: —		
Wages of employees,	$39,720 14	
Travelling expenses,	846 23	
Rent,	181 00	
Supplies,	15,950 39	
Stationery and postage,	1 16	
Printing,	1 25	
Sundries (including teaming),	3,597 57	
		60,297 74
Balance on hand Nov. 30, 1910,		$4,923 87

Financial Summary by Towns.

The following table shows the reimbursement paid to cities and towns for 1908 and 1909, the total net expenditure, the required expenditure before receiving reimbursement and the amount of reimbursement in 1910, and also the required expenditure for 1911: —

	1908. Reimbursement.	1909. Reimbursement.	1910. Required Expenditure.	1910. Total Expenditure.	1910. Reimbursement.	1911. Required Expenditure.
Abington,	$1,493 44	$796 28	$1,175 93	$915 49	–	$1,220 85
Acton,	2,485 81	1,764 27	782 26	2,051 73	$1,269 47	882 65
Amesbury,	378 10	–	2,434 83	2,177 29	–	2,498 99
Andover,	2,365 17	3,095 55	2,588 47	3,918 47	877 77	2,694 88
Arlington,	6,109 09	4,931 26	4,591 97	6,303 41	1,126 27	4,754 91
Ashburnham,	–	–	384 28	–	–	410 75
Ashby,	–	–	212 71	–	–	211 42
Ashland,	341 24	49 31	477 13	560 05	82 92	500 57
Athol,	–	–	1,827 80	–	–	1,857 48
Attleborough,	–	–	5,000 00	–	–	5,000 00
Auburn,	–	–	492 60	–	–	523 20
Avon,	–	–	384 84	506 77	121 93	388 79
Ayer,	–	–	835 41	–	–	871 30
Barnstable,	–	–	2,317 10	–	–	2,456 11
Barre,	–	–	741 20	–	–	820 20
Bedford,	9,466 72	4,608 85	522 90	2,701 02	2,178 12	553 31
Bellingham,	–	–	335 96	–	–	362 66
Belmont,	572 93	164 32	2,511 51	2,146 94	–	2,606 61
Berlin,	460 83	362 95	221 62	572 89	351 27	236 67
Beverly,	1,889 61	818 44	5,000 00	5,698 38	349 19	5,000 00
Billerica,	6,091 09	4,238 66	974 32	3,951 12	2,976 80	1,004 35
Blackstone,	–	–	908 09	–	–	926 16
Bolton,	411 07	686 65	199 14	774 05	574 91	233 44
Boston,	2,500 00	10,000 00	5,000 00	46,561 24	20,000 00	5,000 00
Bourne,	1,489 01	791 61	1,641 55	–	–	1,956 15
Boxborough,	1,805 43	1,438 47	106 79	1,281 67	1,174 88	106 40
Boxford,	2,066 35	2,843 56	520 74	2,517 35	1,996 61	570 00
Boylston,	–	–	193 06	–	–	197 51
Braintree,	1,445 27	–	2,421 92	–	–	2,506 35
Brewster,	–	–	246 40	–	–	272 62
Bridgewater,	–	143 48	1,328 11	1,272 56	–	1,387 13
Brockton,	–	–	5,000 00	–	–	5,000 00
Brookfield,	–	–	508 57	–	–	516 72
Brookline,	–	–	5,000 00	–	–	5,000 00
Burlington,	5,599 44	2,287 91	250 36	2,669 82	2,419 46	278 15
Cambridge,	–	–	5,000 00	–	–	5,000 00
Canton,	–	–	1,654 31	3,046 17	1,391 86	1,816 78
Carlisle,	5,485 58	2,949 83	182 89	2,282 65	2,099 76	190 88

	1908. Reimbursement.	1909. Reimbursement.	1910. Required Expenditure.	1910. Total Expenditure.	1910. Reimbursement.	1911. Required Expenditure.
Carver,	$3,641 27	$1,167 64	$601 89	$1,590 84	$988 95	$843 90
Charlton,	-	-	517 18	-	-	536 06
Chelmsford,	3,740 98	2,057 85	1,809 64	3,282 26	1,472 62	1,767 98
Chelsea,	-	-	5,000 00	-	-	5,000 00
Clinton,	-	-	3,309 63	1,778 02	-	3,375 96
Cohasset,	936 40	3,197 76	3,061 17	5,273 43	1,578 28	3,560 69
Concord,	5,169 66	5,195 79	2,716 27	7,719 43	3 519 62	2,927 71
Danvers,	6,441 71	2,318 50	2,404 85	4,629 51	1,650 86	2,588 17
Dedham,	-	-	5,000 00	-	-	5,000 00
Dennis,	-	-	489 60	-	-	522 72
Douglas,	-	-	493 52	-	-	509 95
Dover,	1,487 56	2,884 61	2,131 26	1,197 55	-	2,189 97
Dracut,	2,462 61	1,218 05	939 68	1,432 65	492 97	988 45
Dudley,	-	-	686 27	-	-	512 77
Dunstable,	544 67	938 24	131 58	1,569 01	1,437 43	142 28
Duxbury,	3,381 91	857 39	881 61	1,366 84	485 23	919 36
East Bridgewater,	3,945 78	902 27	831 45	1,218 83	387 38	834 95
Easton,	-	-	2,115 65	-	-	2,307 89
Essex,	2,096 22	1,099 97	456 91	1,556 49	1,099 58	473 03
Everett,	-	-	5,000 00	1,856 66	-	5,000 00
Falmouth,	-	-	3,243 69	-	-	3,500 67
Fitchburg,	-	-	5,000 00	-	-	5,000 00
Foxborough,	-	-	911 11	-	-	965 99
Framingham,	-	-	4,226 59	2,630 46	-	4,785 18
Franklin,	-	-	1,517 82	-	-	1,575 46
Gardner,	-	-	3,071 08	-	-	3,298 36
Georgetown,	1,151 67	2,055 66	410 16	2,387 65	1,977 49	414 86
Gloucester,	2,063 54	947 56	5,000 00	7,603 17	1,276 59	5,000 00
Grafton,	-	-	1,067 88	362 55	-	1,095 75
Greenfield,	-	-	3,853 77	-	-	4,052 15
Groton,	-	196 72	1,515 70	1,780 73	265 03	1,585 36
Groveland,	1,711 10	1,668 76	465 07	1,506 91	1,041 84	465 39
Halifax,	2,237 83	821 89	213 70	865 04	651 34	213 70
Hamilton,	3,167 63	1,129 22	1,519 37	2,327 35	807 98	1,605 62
Hanover,	4,054 60	1,289 06	591 95	1,030 76	438 81	605 78
Hanson,	1,871 39	691 79	431 80	1,074 38	642 58	502 04
Harvard,	616 61	748 40	493 48	1,266 20	772 72	545 52
Haverhill,	1,131 62	286 52	5,000 00	6,174 37	587 18	5,000 00

	1908. Reimbursement.	1909. Reimbursement.	1910. Required Expenditure.	1910. Total Expenditure.	1910. Reimbursement.	1911. Required Expenditure.
Hingham,	$1,877 15	$1,000 00	$2,441 02	$2,753 38	$13 88	$3,152 60
Holbrook,	–	–	580 26	–	–	590 44
Holden,	–	–	651 99	–	–	658 02
Holliston,	–	–	663 04	–	–	658 07
Hopedale,	–	–	2,096 12	–	–	2,371 14
Hopkinton,	810 16	343 49	631 34	811 19	179 85	623 69
Hubbardston,	–	–	275 85	–	–	275 04
Hudson,	999 59	7 46	1,570 08	1,553 32	–	1,537 45
Hull,	–	–	2,161 33	–	–	2,807 54
Hyde Park,	–	–	5,000 00	476 14	–	5,000 00
Ipswich,	1,757 80	1,236 69	1,914 70	2,769 44	854 74	1,914 20
Kingston,	861 00	889 64	640 91	2,822 56	2,181 65	646 34
Lakeville,	–	–	280 54	–	–	328 37
Lancaster,	–	–	1,656 83	–	–	1,765 67
Lawrence,	–	–	5,000 00	–	–	5,000 00
Leicester,	–	–	965 45	78 70	–	982 62
Leominster,	–	–	4,788 85	–	–	4,959 29
Lexington,	11,139 99	5,306 58	2,903 12	7,596 87	3,343 60	3,130 79
Lincoln,	5,000 00	2,084 18	1,216 10	2,228 37	1,012 27	1,389 57
Littleton,	1,716 01	1,051 05	428 94	1,758 25	1,329 31	454 77
Lowell,	120 42	–	5,000 00	6,835 40	718 86	5,000 00
Lunenburg,	81 34	–	441 06	793 48	352 42	463 73
Lynn,	1,133 22 3,084 27	–	5,000 00	1,755 63	–	5,000 00
Lynnfield,	2,982 45	1,530 23	312 84	1,576 12	1,263 28	397 92
Malden,	–	–	5,000 00	3,543 94	–	5,000 00
Manchester,	–	–	5,000 00	–	–	5,000 00
Mansfield,	–	–	1,580 27	–	–	1,711 68
Marblehead,	–	–	3,101 54	1,913 19	–	3,514 38
Marion,	–	–	1,763 45	–	–	1,993 87
Marlborough,	580 83	369 94	4,128 37	3,803 98	–	4,169 23
Marshfield,	2,389 25	824 61	767 20	1,673 48	906 28	782 93
Mashpee,	104 77	439 05	87 88	633 74	545 86	90 51
Maynard,	1,551 28	654 30	1,548 29	1,539 12	–	1,573 37
Medfield,	–	–	638 60	–	–	639 28
Medford,	4,006 11	4,000 00	5,000 00	10,355 86	2,184 42	5,000 00
Medway,	–	–	579 19	391 78	–	595 12
Melrose,	1,500 00	–	5,000 00	1,840 67	–	5,000 00
Mendon,	–	–	291 48	–	–	280 58

	1908. Reimbursement.	1909. Reimbursement.	1910. Required Expenditure.	1910. Total Expenditure.	1910. Reimbursement.	1911. Required Expenditure.
Merrimac,	$1,598 02	$1,498 21	$498 68	$1,171 29	$672 61	$531 01
Methuen,	3,334 00	1,776 41	2,453 32	3,622 94	808 86	2,879 21
Middleborough,	-	377 46	1,885 95	2,041 33	155 38	1,857 92
Middleton,	2,012 23	1,237 45	316 51	1,430 55	1,114 04	327 33
Milford,	-	-	3,485 24	-	-	3,732 59
Millbury,	-	-	917 32	-	-	941 74
Millis,	-	-	398 03	198 53	-	440 95
Milton,	-	-	5,000 00	6,343 76	7 89	5,000 00
Nahant,	-	-	2,451 60	-	-	3,290 10
Natick,	4,613 56	615 63	3,133 48	3,510 68	-	3,288 64
Needham,	2,443 84	1,254 29	2,322 78	2,373 61	50 83	2,442 13
Newbury,	5,187 19	3,206 28	492 99	2,674 82	2,181 83	505 45
Newburyport,	-	-	4,907 89	-	-	5,000 00
Newton,	2,730 67	8,000 00	5,000 00	28,906 25	7,000 01	5,000 00
Norfolk,	-	-	331 80	-	-	349 08
North Andover,	3,238 23	3,045 08	1,841 44	2,192 20	350 76	1,975 09
North Attleborough,	-	-	2,737 98	-	-	3,092 90
North Reading,	2,757 26	2,807 28	542 32	2,110 70	1,830 05	294 56
Northborough,	-	-	1,744 38	-	-	556 54
Northbridge,	-	-	280 65	-	-	1,837 84
Norwell,	2,291 57	1,019 70	367 98	1,309 50	941 52	423 62
Norwood,	-	-	5,000 00	-	-	5,000 00
Orange,	-	-	1,445 19	-	-	1,481 88
Orleans,	-	-	252 53	-	-	273 60
Oxford,	-	-	775 25	-	-	786 53
Palmer,	-	-	1,671 17	-	-	1,745 87
Paxton,	-	-	133 18	-	-	135 80
Peabody,	4,208 67	1,698 36	4,156 73	4,940 92	627 35	4,436 42
Pembroke,	1,109 72	791 90	376 90	1,511 55	1,134 65	381 62
Pepperell,	870 79	745 59	901 22	2,471 76	1,570 54	155 05
Petersham,	-	-	360 87	-	-	374 33
Phillipston,	-	-	113 54	-	-	113 48
Plainville,	-	-	317 85	-	-	328 78
Plymouth,	-	-	4,346 09	-	-	4,510 32
Plympton,	5,504 87	1,780 71	150 30	1,702 50	1,552 20	155 05
Princeton,	-	-	438 87	-	-	454 15
Quincy,	1,550 24	55 52	5,000 00	4,692 51	-	5,000 00
Randolph,	-	-	826 48	-	-	922 96

	1908. Reimbursement.	1909. Reimbursement.	1910. Required Expenditure.	1910. Total Expenditure.	1910. Reimbursement.	1911. Required Expenditure.
Raynham,	$70 80	–	$307 47	$327 69	$20 22	$309 49
Reading,	6,974 30	$5,293 45	2,181 77	3,952 73	1,770 96	2,358 75
Revere,	–	–	5,000 00	1,941 63	–	5,000 00
Rochester,	96 34	98 75	257 35	353 05	95 70	289 38
Rockland,	675 17	193 22	1,589 06	1,519 45	–	1,690 45
Rockport,	800 34	240 66	1,309 19	1,843 81	534 62	1,370 67
Rowley,	1,047 73	1,026 59	298 94	1,192 46	893 52	367 45
Royalston,	–	–	228 19	–	–	240 82
Rutland,	–	–	288 47	–	–	312 49
Salem,	2,818 68	334 00	5,000 00	5,367 11	183 56	5,000 00
Salisbury,	2,103 91	1,290 50	356 54	1,614 11	1,257 57	363 15
Sandwich,	494 08	128 83	405 29	544 45	139 16	410 53
Saugus,	12,243 30	7,747 29	2,082 51	6,226 00	4,143 49	2,204 21
Scituate,	–	1,351 60	1,790 26	2,795 31	1,005 05	1,863 08
Sharon,	–	–	1,105 51	–	–	1,114 01
Sherborn,	1,463 82	756 34	592 24	820 96	228 72	556 54
Shirley,	–	–	433 69	541 10	107 41	478 45
Shrewsbury,	–	–	653 07	–	–	697 72
Somerville,	–	–	5,000 00	668 62	–	5,000 00
Southborough,	984 33	1,105 88	733 56	984 72	251 16	779 71
Spencer,	–	–	1,416 42	–	–	1,414 28
Springfield,	–	–	5,000 00	–	–	5,000 00
Sterling,	–	–	453 08	–	–	466 91
Stoneham,	8,052 48	2,637 99	2,021 00	2,275 18	254 18	2,022 37
Stoughton,	–	–	1,399 13	–	–	1,422 00
Stow,	773 80	878 52	375 39	1,516 25	1,140 86	409 87
Sturbridge,	–	–	426 65	–	–	439 63
Sudbury,	2,390 60	1,550 53	501 99	1,891 06	1,389 07	526 98
Sutton,	–	–	516 34	–	–	527 21
Swampscott,	1,509 10	–	4,050 37	4,547 50	397 71	4,475 02
Taunton,	–	–	5,000 00	–	–	5,000 00
Templeton,	–	–	634 61	–	–	648 87
Tewksbury,	1,771 69	1,745 42	508 38	1,975 10	1,466 72	586 94
Topsfield,	1,725 26	1,404 32	508 09	1,503 54	995 45	635 73
Townsend,	–	–	469 92	1,037 11	567 19	530 33
Truro,	–	–	149 06	–	–	151 65
Tyngsborough,	1,505 38	1,892 27	223 53	2,061 04	1,837 51	231 92
Upton,	–	–	444 37	–	–	450 27

	1908. Reimbursement.	1909. Reimbursement.	1910. Required Expenditure.	1910. Total Expenditure.	1910. Reimbursement.	1911. Required Expenditure.
Uxbridge,	–	–	$1,140 23	–	–	$1,197 32
Wakefield,	$4,297 83	$1,446 07	3,635 64	$5,438 50	$1,190 98	3,752 22
Walpole,	–	–	1,750 25	649 90	–	2,161 03
Waltham,	3,340 13	616 60	5,000 00	7,008 12	224 99	5,000 00
Wareham,	–	–	1,884 49	–	–	2,025 56
Warren,	–	–	769 59	–	–	761 50
Warwick,	–	–	171 39	–	–	176 98
Watertown,	399 36	–	5,000 00	3,513 49	–	5,000 00
Wayland,	4,603 00	2,989 29	937 77	2,895 98	1,956 51	1,136 06
Webster,	–	–	2,962 92	–	–	3,115 91
Wellesley,	587 42	886 08	5,000 00	5,585 70	249 77	5,000 00
Wellfleet,	–	–	495 76	–	–	438 36
Wenham,	1,577 95	2,977 10	1,007 04	1,599 72	592 68	1,027 19
West Boylston,	–	–	311 89	–	–	330 82
West Bridgewater,	1,342 17	499 40	508 54	824 08	315 54	536 87
West Newbury,	7,316 20	2,838 64	430 97	1,097 77	666 80	429 67
Westborough,	–	–	1,306 06	–	–	1,297 66
Westford,	2,727 41	2,165 92	733 29	3,297 22	2,563 93	772 89
Westminster,	–	–	314 09	312 87	–	344 52
Weston,	10,541 99	4,600 00	2,733 10	5,052 73	1,078 63	2,769 70
Westwood,	–	–	1,038 27	–	–	1,180 14
Weymouth,	1,542 86	300 73	3,197 19	2,341 38	–	3,143 23
Whitman,	–	–	1,949 34	–	–	1,997 89
Wilmington,	3,803 51	2,974 23	555 91	2,347 00	1,791 09	609 12
Winchendon,	–	–	1,644 50	–	–	1,673 72
Winchester,	808 08	–	4,988 65	3,704 73	–	5,000 00
Winthrop,	–	–	4,797 44	–	–	5,000 00
Woburn,	7,624 59	5,969 40	4,478 69	8,872 57	3,263 35	4,596 60
Worcester,	–	–	5,000 00	–	–	5,000 00
Wrentham,	–	–	480 48	–	–	512 36
Yarmouth,	–	–	834 74	–	–	886 01

Summary of Recommendations.

For General Forestry.

First. — To enact a law defining the powers and duties of the State Forester with regard to forest fires.

Second. — To enact a law regulating the handling of brush, or slash, throughout the State, in order to lessen the danger of fire.

Third. — That the law requiring permits to set fires in the open air be so amended as to apply to all cities and towns in the Commonwealth; also, to lengthen the time during which such permits are required, so as to include the month of March.

Fourth. — That an increased appropriation be made to carry on the work of reforestation, and for the general expenses of the State Forester's department.

For Moth Suppression.

Fifth. — That the law relative to the suppression of the gypsy and brown-tail moths be so amended that the State Forester may take supervision of the work in cities and towns so desiring it, or where economy and efficiency demand it.

Sixth. — That the usual additional appropriation for gypsy and brown-tail moth suppression, and the importation of their natural enemies, which has been $165,000, be again made this year.

Seventh. — The passage of a resolution by the Massachusetts Legislature, urging upon the Congress of the United States the necessity for more assistance in suppressing and checking the spread of the gypsy and brown-tail moths.

Eighth. — That the appropriations be made available by March 1, as more economic results can thus be obtained.

Respectfully submitted,

F. W. RANE,
State Forester.